PAGE'S WEEKLY.—April 7, 1905.

Thin Paper Copy for Circulation Abroad.

No. 30. Vol. 6.

SIXPENCE.
(Registered as a Newspaper.)

FRIDAY,
APRIL 7, 1905.

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PAGE'S WEEKLY

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SHIPBUILDING ◆ MINING
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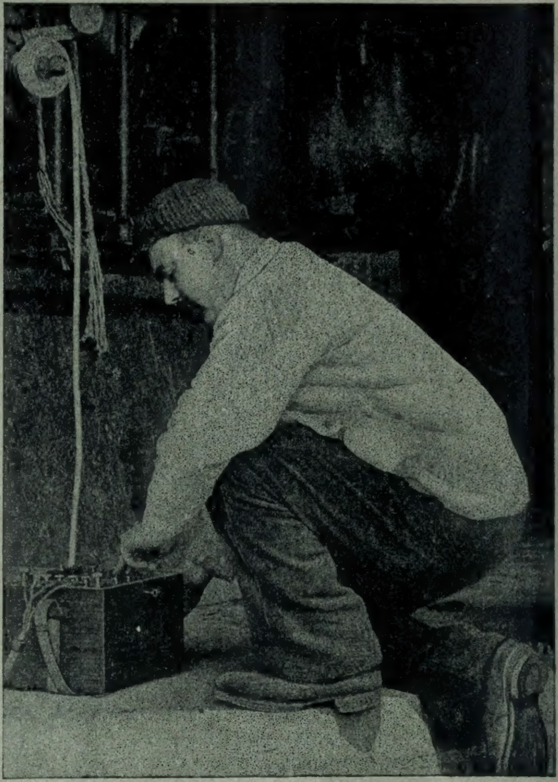

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PAGE'S WEEKLY Miscellaneous

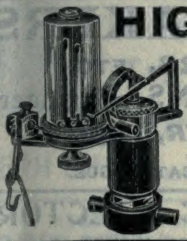
Mr. G. H. HUGHES, M.I.Mech.E.,

Consulting and Organising Engineer for Water Works and Industrial Undertakings,

97, QUEEN VICTORIA ST., LONDON, E.C.

Telephone No.: 5754 Bank. Write for particulars.

McINNES'S PATTERN.



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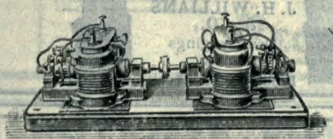

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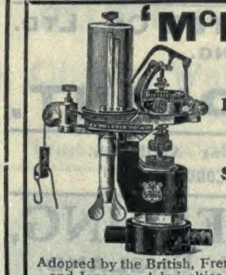

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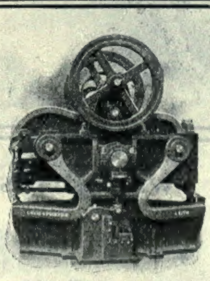

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PAGE'S WEEKLY Miscellaneous

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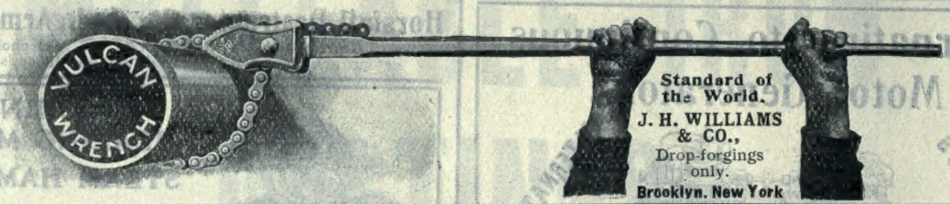

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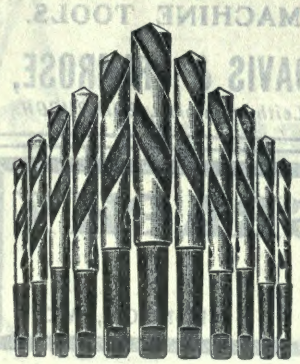

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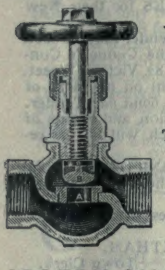
PAGE'S WEEKLY Miscellaneous



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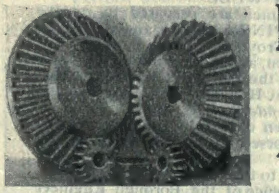

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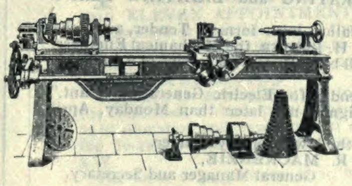

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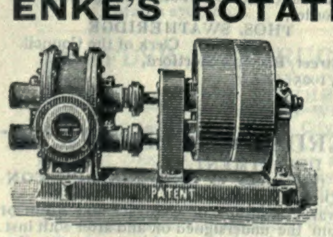

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12, Mark Lane, LONDON, E.C.
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PAGE'S WEEKLY Contracts

CONTRACTS.

NEW SOUTH WALES.—TENDERS FOR IRON AND STEEL.

TENDERS will be received at the office of the Secretary for Public Works, Sydney, Australia, up to Two o'clock p.m. on Friday, September 1st, 1905, for the MANUFACTURE, SUPPLY, and DELIVERY, in the State of New South Wales, of all IRON and STEEL REQUIRED by the GOVERNMENT.

Full particulars may be obtained from the Agent-General's Office, 9, Victoria Street, London, S.W.

JERSEY,
Acting Agent-General for New South Wales.
London,
March 24th, 1905.

COUNTY BOROUGH OF CROYDON.

STROUD GREEN WELL.

Notice is hereby given that the Council are prepared to receive **TENDERS** for a **DEEP WELL PUMPING ENGINE** and **BOILERS** for the Stroud Green Well, Woodside, Croydon.

Particulars and conditions may be seen, and a copy obtained on payment of a deposit of One Guinea, at the office of GEO. F. CARTER, A.M.Inst.C E., Borough Engineer, Town Hall, Croydon. The deposit will be returned upon receipt of a *bonâ fide* Tender.

Tenders to be sent to me by Eleven o'clock in the forenoon on Wednesday, the 26th April, 1905, endorsed "Pumping Plant, Stroud Green Well."

Tenders will only be received subject to the terms of the draft contract which has been deposited at the office of the Borough Engineer as aforesaid, and may be inspected during office hours.

The Council will not be bound to accept the lowest or any Tender.

F. C. LLOYD,
Town Clerk.
Town Hall, Croydon,
March 31st, 1905.

CLYDE NAVIGATION.—TO MECHANICAL AND ELECTRICAL ENGINEERS.

ELECTRIC POWER GENERATING AND LIGHTING PLANT.

The Trustees of the Clyde Navigation invite **TENDERS** for **ELECTRIC POWER GENERATING** and **LIGHTING PLANT** for Clydebank Dock.

Copies of the general specification, with form of Tender, are to be had at this office, from Mr. GEO. H. BAXTER, the Mechanical Engineer, on payment of £3 3s., which will be refunded on receipt of a *bonâ fide* Tender.

Sealed Tenders, marked "Tender for Electric Generating Plant," to be lodged with the undersigned not later than Monday, April 10th, 1905.

The Trustees may not accept the lowest or any Tender.

T. R. MACKENZIE,
General Manager and Secretary.
16, Robertson Street, Glasgow,
March 10th, 1905.

BOROUGH OF BATLEY.—BRADFORD ROAD TRAMWAYS RECONSTRUCTION.

The Batley Corporation invite **TENDERS** for the following Works in connection with the Extension of the Tramways in Bradford Road:—

Contract No. 14.—PERMANENT WAY CONSTRUCTION and PAVING.

Contract No. 15.—OVERHEAD EQUIPMENT, STEEL POLES, etc.

Contract No. 16.—FEEDER CABLES, CONDUITS, and ACCESSORIES.

Copies of the General Conditions, Specifications, Quantities, Form of Tender and Drawings may be obtained from Messrs. LACEY, SILLAR, AND LEIGH, 2, Queen Anne's Gate, Westminster, on and after the 29th inst., on payment of a deposit of £2 2s. in respect of each Contract, which will be returned on receipt of a *bonâ fide* Tender. Further copies of the Specification or Quantities can be obtained on payment of a further fee of Half-a-Guinea per copy, which will not be returned.

Tenders on the prescribed form, and endorsed "Tramways, Contract No. —," to be delivered at my office not later than April 17th proximo.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
JOS. HANSON CRAIK,
Town Clerk.
Town Clerk's Office, Batley,
March 21st, 1905.

TENDERS will be received by the Montreal Water and Power Company up to May 15th next on a Fifteen Million Gallon High-duty **STEAM PUMPING PLANT, BOILERS**, etc., 175 lb. water pressure. Specifications can be had on application to the Office of the above Company, 62, Alliance Building, 107, St. James Street, Montreal, Canada.

MUNICIPALITY OF JOHANNESBURG.

SPECIFICATION No. 15.—SWITCHBOARDS.

The Council is prepared to receive **TENDERS** for the Supply and Erection of **SWITCHBOARDS** and **ACCESSORIES** for their New Direct and Alternating-current Power Station.

General Conditions, Specification, and Forms of Tender may be seen on and after Friday, March 31st, at the offices of the Council's Consulting Engineers, Messrs. MORDEY AND DAWBARN, 82, Victoria Street, Westminster, S.W., and may be obtained from them on payment of Five Guineas, which will be returned on receipt of a *bonâ fide* Tender. Further copies of the General Conditions, Specification, and Forms of Tender may be obtained on payment of 10s., which will not be returned.

Tenders are to be addressed to Messrs. MORDEY AND DAWBARN, 82, Victoria Street, Westminster, S.W., and must reach them not later than noon on Thursday, April 27th, 1905.

The Council does not bind itself to accept the lowest or any Tender, and is not responsible for the cost of tendering.

R. FEETHAM,
Town Clerk.
Johannesburg,
March 27th, 1905.

MUNICIPAL COUNCIL OF GEORGE TOWN, PENANG.

ELECTRIC LIGHTING.

The Commissioners invite **TENDERS** for the Supply and Delivery f.o.b., of a:—

300kw. **STEAM DYNAMO, MOTOR GENERATOR, BALANCER, SWITCHBOARDS**, &c.

Copies of the Specification, with Form of Tender and General Conditions, can be obtained at the Offices of Messrs. PREECE AND CARDEW, 8, Queen Anne's Gate, Westminster, S.W., upon payment of a fee of One Guinea, which will be returned upon receipt of a *bonâ fide* Tender.

Duplicate Copies of the Specification can be obtained on payment of 5s., which will not be returnable.

Sealed Tenders, endorsed "Tender for Steam Dynamo, &c.," must be delivered to Mr. R. M. CHRISTIE, 4, East India Avenue, E.C., on or before 12 o'clock noon on Tuesday, April 18th, 1905.

The Commissioners do not bind themselves to accept the lowest or any Tender.

BISHOP'S STORTFORD URBAN DISTRICT COUNCIL.

CONTRACTS.

Subject to the sanction of the Local Government Board being obtained to the necessary loans, the **COUNCIL** invite **TENDERS** for the **CARRYING OUT** of the **FOLLOWING WORKS** at their Sewage Pumping Station—viz.:—

CONTRACT No. 1.—For Supplying and Fixing Two Lancashire Boilers, 18 feet long by 6 feet 6 inches diameter.

CONTRACT No. 2.—For Supplying and Fixing Steam Pumping Engine and Pumps.

In connection with this Contract, persons tendering are required to submit detailed Drawings and Specifications of the type of Engine and Pumps they propose to supply.

CONTRACT No. 2A.—For Supplying and Fixing Gas Pumping Engine and Pumps, together with Suction Gas Plant complete.

Printed Specifications and Forms of Tender will be forwarded on application to the undersigned. Applications to be accompanied by a deposit of £2 2s. in each case, which will be returned on receipt of a *bonâ fide* Tender.

The person or firm whose Tender is accepted will be required to enter into a written contract and to provide two sureties.

Sealed Tenders, endorsed "Contract No. —" to be sent to me by 4 o'clock p.m. on Monday, the 8th day of May, 1905.

The Council do not bind themselves to accept any Tender.

By order,
THOS. SWATHERIDGE,
Clerk of the Council.
Council Offices, 7, North Street, Bishop's Stortford,
March 17th, 1905.

CITY OF ABERDEEN.—ELECTRICITY DEPARTMENT.

Tenders are invited for the Supply of **ONE SURFACE CONDENSER**, with Air Pump, Oil Separator, etc.

Specification, with General Conditions of Contract and Form of Tender may be obtained from the undersigned on and after 29th inst. on payment of £2, which sum will be returned upon receipt of a *bona fide* Tender.

Offers, endorsed "Tenders for Condenser," and addressed to the Engineer, must be delivered at or before noon on Wednesday, April 19th.

Corporation Electricity Works,
Millburn Street, Aberdeen.
J. ALEX. BELL,
City Electrical Engineer.

PAGE'S WEEKLY Contracts

THE SECRETARY OF STATE FOR India in Council is prepared to receive **TENDERS** from such persons as may be willing to supply:—

1. **TYRES** for Carriage and Wagon Wheels.
2. **WHEELS** and **AXLES** for Wagons.
3. **LOW-SIDED WAGONS.**

The Conditions of Contract may be obtained on application to the Director-General of Stores, India Office, Whitehall, S.W., and Tenders are to be delivered at that Office by Two o'clock p.m., on Tuesday, April 11th, 1905, for Nos. 1 and 2, and on Tuesday, April 18th, 1905, for No. 3, after which times respectively no Tender will be received.

India Office, Whitehall, E. GRANT BURLS,
March 30th, 1905. Director-General of Stores.

CLYDE NAVIGATION.—TO BOILER-MAKERS.

BOILERS AND SUPERHEATING APPARATUS.

The Trustees of the Clyde Navigation invite **TENDERS** for **BOILERS** and **SUPERHEATING APPARATUS** for Electric Power Generating Plant at Clydebank Dock.

Copies of the specification and form of Tender are to be had at this Office, from Mr. GEO. H. BAXTER, the Mechanical Engineer, on payment of £2 2s., which will be refunded on receipt of a *bona fide* Tender.

Sealed Tenders, marked "Tender for Boilers and Superheating Apparatus," to be lodged with the undersigned not later than noon on Monday, April 17th, 1905.

The Trustees may not accept the lowest or any Tender.

16, Robertson Street, Glasgow, T. R. MACKENZIE,
March 24th, 1905. General Manager and Secretary.

CLYDE NAVIGATION.—TO SHIP-BUILDERS.

DREDGER.

The Trustees of the Clyde Navigation invite **TENDERS** for a **BOW-WELL CENTRE-LADDER SELF-PROPELLING DREDGER.**

Drawings may be seen, and copies of the specification and form of Tender obtained, on application at this office to Mr. GEO. H. BAXTER, the Mechanical Engineer, on payment of £5 5s., which will be refunded on receipt of a *bonâ fide* Tender.

Sealed Tenders, marked "Tender for Dredger," to be lodged with the undersigned not later than noon on Monday, April 17th, 1905.

The Trustees may not accept the lowest or any Tender.

16, Robertson Street, Glasgow, T. R. MACKENZIE,
March 22nd, 1905. General Manager and Secretary.

HADHAM RURAL DISTRICT COUNCIL.

HADHAM WATER SUPPLY.

CONTRACT No. 2.

The Hadham Rural District Council invite **TENDERS** for the following **WORKS** and **MACHINERY** at the Pumping Station in the parish of Much Hadham, Herts:—

The Sinking of a Borehole 8½ in. in diameter, 270 ft. deep, with all requisite Steel Lining Tubes.

The Supply and Fixing of No. 2 Deep Well Pumps and No. 2 Oil Engines, with all necessary Fittings and Connections.

Drawings and specifications may be seen at the offices of the Engineers, Messrs. POLLARD AND TINGLE, 31, Old Queen Street, Westminster, and form of Tender and specification can be obtained at my office only upon the deposit of £5, which will be refunded upon receipt of a *bonâ fide* Tender made out on the provided form and the return of the specification.

Sealed Tenders, addressed to me, and endorsed "Tender for Hadham Borehole and Machinery," are to be delivered at my office not later than 10 a.m. on Thursday, April 13th, 1905.

The Council do not bind themselves to accept the lowest or any Tender.

ALFRED G. GWYNN,
Clerk to the Hadham Rural District Council.

Bishops Stortford,
March 27th, 1905.

REFUSE DESTRUCTOR AND FLAG-MAKING PLANT.

MUNICIPAL COUNCIL OF THE CITY OF SYDNEY, NEW SOUTH WALES.

The Municipal Council of the City of Sydney, New South Wales, invite **TENDERS** for the **SUPPLY** and **ERECTION** of **SIX-CELL REFUSE DESTRUCTOR** and for a **FLAG-MAKING PLANT** at Moore Park, within the City of Sydney, New South Wales.

Conditions of Contract, Specifications, and Tender Forms may be obtained on application to the Acting Agent-General for the State of New South Wales, Victoria Street, Westminster, S.W.

Tenders will be received up to Tuesday, May 30th, 1905, addressed to the Town Clerk, Town Hall, Sydney, New South Wales, endorsed "Tenders for Destructor and Flag Plant."

THOMAS H. NESBITT,
Town Clerk.

Town Clerk's Room, Town Hall, Sydney,
February 9th, 1905.

VICTORIAN RAILWAYS.—TENDERS are invited for the **MANUFACTURE, SUPPLY,** and **DELIVERY** of **STEEL RAILS** and **FISH-PLATES.**

Tenders, accompanied by the preliminary deposit of £250, must be lodged in the Tender Box at the Railway Offices, Melbourne, Victoria, Australia, or at the office of the Agent-General for Victoria, 142, Queen Victoria Street, London, E.C., before 1 p.m., on Monday, April 10th, 1905.

Charge for specification with drawing, 7s. 6d.

BOSTON UNION.—LAUNDRY FITTINGS, MACHINERY, ENGINE AND BOILER

FOR NEW LAUNDRY AT THE WORKHOUSE, BOSTON.

The Guardians of the Poor of the Boston Union are prepared to receive **TENDERS** for **LAUNDRY FITTINGS, MACHINERY, ENGINE** and **BOILER** for the new Laundry proposed to be erected at the Workhouse, Boston.

Persons desirous of tendering for the above are to send in their names to the Architect, Mr. JAMES ROWELL, Church Lane, Boston, Lincolnshire, on or before March 25th, 1905.

Plans of the buildings and particulars of requirements may be inspected at the Architect's Office.

A copy of the plans of the buildings and requirements may, by arrangement with the Architect, be obtained on loan, on a deposit of £2, which sum will be returned on receipt of a *bonâ fide* Tender, &c., and the copy of plans and particulars, by time agreed.

Tenders, &c., to be sealed and endorsed "Tender for Laundry Machinery," and sent, addressed to the undersigned, not later than April 15th, 1905.

There is no undertaking to accept the lowest or any Tender, nor will any expenses be paid in connection therewith.

Clerk's Office, JOHN M. SIMPSON,
28, Wide Bargate, Boston, Clerk to the Guardians.
March 11th, 1905.

APPOINTMENTS OPEN.

INDIAN PUBLIC WORKS DEPARTMENT.

THE SECRETARY OF STATE FOR India in Council will, in the Summer of 1905, make not less than **ELEVEN APPOINTMENTS** of **ASSISTANT ENGINEER** in the permanent establishment of the Indian Public Works Department in addition to the appointments to be made from Coopers Hill College.

The age of candidates must not be less than 21, or more than 24, years on the 1st July, 1905.

A printed form of application, together with information regarding the conditions of the appointments and certain requirements laid down as to education and experience in engineering may be obtained from the Secretary Public Department, India Office, Whitehall, London, S.W.

The form of application is to be returned not later than Monday 1st May next.

A. GODLEY,
India Office, Under Secretary of State.
February 24th, 1905.

TWICKENHAM URBAN DISTRICT COUNCIL.

CLERK OF WORKS.

The above Council invite **APPLICATIONS** for the **APPOINTMENT** of **CLERK** of **WORKS** in connection with the erection of new pumping station and destructor buildings and the construction of settling tanks, contact beds, &c., at the Council's Sewage Disposal Works.

The appointment will be for a period of about twelve months, at a salary of £4 per week, and candidates must have had good experience as clerk of works in connection with the carrying out of buildings and works of a similar nature,

Applications, endorsed "Clerk of Works," stating age and experience and accompanied by copies of not more than three recent testimonials must be forwarded so as to reach me not later than noon on Wednesday, the 12th day of April, 1905.

Canvassing members of the Council directly or indirectly will disqualify any candidate.

By order,
H. JASON SAUNDERS,
Town Hall, Twickenham. Clerk to the Council.
March 23rd, 1905.

STOREKEEPER.—Wanted, Situation in large Engineering Works, by thoroughly reliable and competent man; long experience, good stock and book-keeper; excellent references.—PROGRESSIVE, 28, Osborne Road, Sharrow, Sheffield.

BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages 23, and 25.*

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

Belting.
Binney & Son, Catherine Street. City Road, London, E.C.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.
Hartley & Sugden, Ltd., Halifax.

Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Cochran & Co. (Annan), Ltd., Annan, Scotland.
Stirling Boiler Co., Ltd., Motherwell, N.B.

Bolts, Nuts, Rivets, etc.
Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T. D. Robinson & Co., Ltd., Derby.

Books.
Crosby Lockwood & Son, Stationers' Hall Court, London, E.C.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N., 125, Strand, W.C.
World's Work and Play.

Cables.
St. Helen's Cable Co., Ltd., Warrington, Lancashire.

Case-Hardening Compounds.
Hy. Miller & Co., Millgarth Works, Leeds.

Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Southwood, Smith & Co., Ltd., Plough Court, Fetter Lane, London, E.C.
Spottiswoode Advertising Agency, 8, New Street Square, E.C.
Stafford, Arthur, & Co., Denton, Manchester.

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.

Colliery Plants.
Graham, Morton & Co., Ltd., Leeds.

Condensing Plant.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Condensed Water Purifiers.
Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

Consulting Engineers.
Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 97, Queen Victoria Street, London, E.C.
Melville & Macalpine, 615, Walnut Street, Philadelphia, Pa., U.S.A.

Continental Railway Arrangements.
South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Graham, Morton & Co., Ltd., Leeds.
Temperley Transporter Co., 72, Bishopsgate Street Within, London E.C.

Coverings (Boiler).
Magnesia Coverings, Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.
Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham.

Destructors.
Heenan & Froude, 4, Chapel Walks, Manchester.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.
Delange & Cie, Mce., Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Drilling Machines.
Swift, George, Claremont Ironworks, Halifax.

Economisers.
E. Green & Son Ltd., Manchester.

Ejectors (Pneumatic).
Hughes & Lancaster, 47, Victoria Street, London, S.W.

Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., The Silvertown, London, E.
Mather & Platt, Ltd., Salford Iron Works, Manchester.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
Newton Brothers, Full Street, Derby.
Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co., 22, Rosoman Street, Clerkenwell, London, E.C.

Engineers' Supplies.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Engines (Gas).
Campbell Gas Engine Co., Ltd., Halifax.
Soest, L., & Co., Ltd., 114-116, Victoria Street, London, S.W.

Engines (Electric Lighting).
McLaren, J. and H., Midland Engine Works, Leeds.

Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A.
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.
McLaren, J. & H., Midland Engine Works, Leeds.

Engines (Portable).
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.

Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House, Finsbury Circus, London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.
Mirrlees Watson Co., Ltd., Glasgow.

Engines (Traction).
Jno. Fowler & Co. (Leeds), Ltd., Steam Plough Works, Leeds.
Garrett & Sons, Ltd., Richard, Leiston, R.S.O., Suffolk.

Engravers.
Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C.

Exhaust Steam Oil Separators.
Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

Fans, Blowers.
Capel Fan Co., 13, Moseley Street, Newcastle-on-Tyne.
Davidson & Co., Ltd., "Sirocco" Engineering Works, Belfast, Ireland.
Gibbs, John & Son, 80, Juke Street, Liverpool.
James Keith & Blackman Co., Ltd., 27, Farringdon Avenue, London, E.C.
Matthews & Yates, Ltd., Swinton, Manchester.

Fire Bricks.
J. H. Sankey & Son, Ltd., Essex Wharf, Canning Town, London, E.

PAGE'S WEEKLY Wells' Specialities

PORTABLE LIGHT FROM OIL

UP TO 4,000 CANDLE POWER.

Adopted by 26 Governments and all Leading Firms. Over 17,000 sold. Over 1,500 supplied to British and Foreign Railways.

Each Lamp Guaranteed.

Horizontal Flame Unaffected by Weather.

	PRICE COMPLETE.
No. 0.—500 Candles, small hand pattern, for petroleum	£7 7 0
No. 1.—1,500 Candles, hand pattern, with No. 2 size burner for Tar Oil ...	£10 0 0
No. 2.—1,500 or 2,000 Candles, useful and portable pattern	£15 10 0
No. 3. 2,500 or 3,500 Candles, Manchester Ship Canal pattern ...	£16 10 0
No. 4.—3,500 or 4,000 Candles. A most powerful lamp	£17 15 0

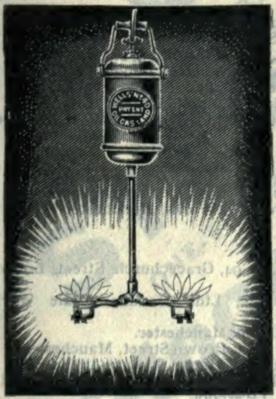
These Lamps are arranged to burn Kerosene or Petroleum when sent to Foreign Countries; but in Great Britain our Special Wells Oil is supplied, which is half the price, and gives 30 per cent. more light. Special prices for our oil may be had on application to our Agents or direct to us.

For Electrical Engineers, Contractors, Builders, Docks, Railways, &c.

This Lamp will not blow out in a high wind, produces a clear white light of about 200 candle power, from ordinary paraffin or petroleum. The tank holds 1½ gallons of oil, burning six hours.

Price **£3** each.

Extra Burners **3/-** each.



WELLS' OIL GAS GENERATING LAMP No. 40.

Weight, 10 lb. Capacity, 7 pints. Burning about 7 hours.

Made in Sheet Steel, with top and bottom of our "Unbreakable" Metal, for Lightness and Strength, with large Capacity.

Price, with Single Burner...	16/- each.
Double "	19/- "
Tripod Stands ...	3/- "
Extra Burners ...	2/- "

A. C. WELLS & Co.,

100a, Midland Road, St. Pancras,
LONDON, N.W.

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(Wallwork and Wells' Patents.)

PAINTING BY MACHINE.

Great Saving in Time, Paint, and Labour.

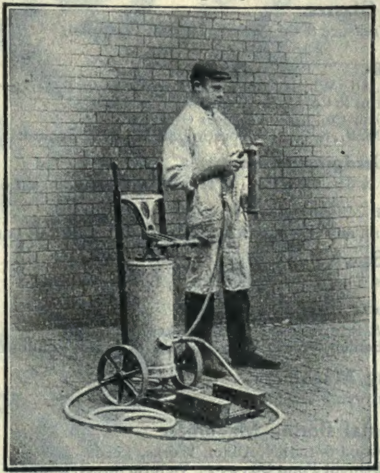
PAINTING SPEED—3 square yards a minute.

The paint is sprayed evenly and continuously through a flexible tube and nozzle supplied with compressed air, either from existing air main or from our special Compressors.

No. 1 Painter (as above Illustration) ...	£25 0 0
No. 2 "	£30 0 0
No. 3 "	£35 0 0
Single Air Compressor	£17 10 0
Double Air Compressor	£27 0 0

HAND AIR COMPRESSORS,

Paint Holder and Sprayer Combined.



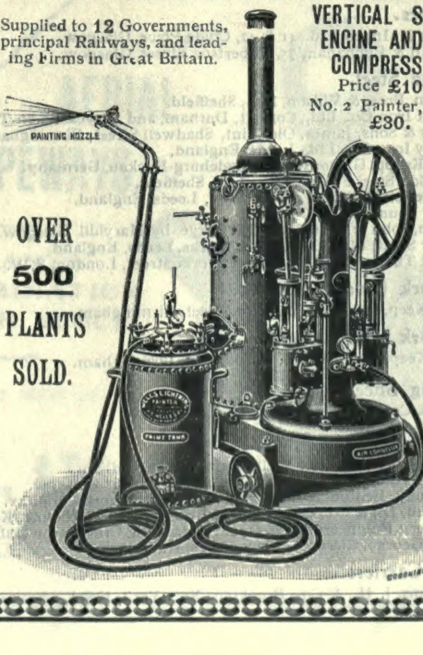
Invaluable for ELECTRICAL WORK, STENCILLING, ORNAMENTING, DECORATING, &c.,
or any class of painting where the work is not very heavy or continuous.

Price, Complete ... ... £16.
Hand Sprayer and Hose supplied separately, **£9.**

Supplied to 12 Governments, principal Railways, and leading Firms in Great Britain.

VERTICAL STEAM ENGINE AND AIR COMPRESSOR.

Price **£100.**
No. 2 Painter, extra **£30.**



OVER
500
PLANTS
SOLD.

Buyers' Directory—(*Continued*).

Firewood Machinery.
M. Glover & Co., Patentees and Saw Mill Engineers, Leeds.

Fountain Pens.
Mabie, Todd & Bard, 93, Cheapside, London, E.C.

Forging (Drop) Plants.
Brett's Patent Lifter Co., Ltd., Coventry.

Forgings (Drop).
J. H. Williams & Co., Brooklyn, New York, U.S.A.

Furnaces.
Deighton's Patent Flue & Tube Company, Vulcan Works, Pepper Road, Leeds.
Leeds Forge Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.

Gas Producers.
Graham, Morton & Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.
Power-Gas Corporation, Ltd., 39, Victoria Street, London, S.W.

Gauge Glasses.
J. B. Treasure & Co., Vauxhall Road, Liverpool.

Gearing.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.
Hamilton & Co., J. B., 145, Cannon Street, E.C.
Reid Gear Co., Linwood, near Glasgow.
Wild, M. B., & Co., Corporation Street, Birmingham.

Gold Dredging Plant.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Greases.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.

Hack Saws.
Baynes, Charles, Knuzden Brook, Blackburn.

Hammers (Steam).
Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hoisting Machinery.
See Conveying Machinery.

Horizontal Boring Machines.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hydraulic Leather.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Icemaking and Refrigerating Machinery.
H. J. West & Co., 114-118, Southwark Bridge Road, London, S.E.

Indicators.
Dobbie McInnes, Ltd., 41 & 42, Clyde Place, Glasgow.
Hannan & Buchanan, 75, Robertson Street, Glasgow.

Iron and Steel.
Askham Bros. & Wilson, Ltd., Sheffield.
Consett Iron Co., Ltd., Consett, Durham, and Newcastle-on-Tyne.
Fairley & Sons, James, Old Mint, Shadwell Street, Birmingham.
Farnley Iron Co., Ltd., Leeds, England.
Fried. Krupp, Grusonwerk, Magdeburg-Buckau, Germany.
Hadfield's Steel Foundry Co., Ltd., Sheffield.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co., Derby.
Purden, John & Sons, Lambhill Forge, by Maryhill, Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.
Gilbert Thompson & Co., 116, Victoria Street, London, S.W.

Ironwork (Constructional).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Ironwork (Galvanised).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Lagging Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

Lathes.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Eclipse Tool Manufacturing Co., Linwood, near Glasgow.
Leckenby, Benton, & Co., Perseverance Ironworks, Halifax.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Northern Engineering Co. (1900) Ltd., King Cross, near Halifax.
Swift, George, Claremont Ironworks, Halifax.

Lathe Carriers.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Laundry Machinery.
W. Summerscales & Sons, Ltd., Engineers, Phœnix Foundry, Keighley, England.

Lifts.
Waygood & Co., Ltd., Falmouth Road, London, S.E.

Lubricants.
Blumann & Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Reliance Lubricating Oil Co., The, 19 & 20, Water Lane, Great Tower Street, London, E.C.
Matthew Wells & Co., Hardman Street Oil Works, Manchester.

Machine Tools.
Asquith, William, Ltd., Highroad Well Works, Halifax.
George Addy & Co., Waverley Works, Sheffield.
Bateman's Machine Tool Co., Hunslet, Leeds.
Hy. Berry & Co., Ltd., Leeds.
Bertrams, Ltd., St. Katherine's Works, Sciennes, Edinburgh.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Breuer, Schumacher & Co., Ltd., Kalk, near Cologne-on-Rhine (Germany).
Cunliffe & Croom, Ltd., Broughton Ironworks, Manchester.
Dean, Smith & Grace, Ltd., Keighley.
Greenwood & Batley, Ltd., Leeds.
Jones & Lamson Machine Co., 97, Queen Victoria Street, London, E.C.
John Lang & Sons, Johnstone, near Glasgow.
Luke & Spencer, Ltd., Broadheath, Manchester.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Jos. C. Nicholson Tool Co., City Rd. Tool Wks., Newcastle-on-Tyne.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne.
Northern Engineering Co., 1900, Ltd., King Cross, near Halifax.
J. Parkinson & Son, Canal Ironworks, Shipley, Yorkshire.
C. Redman & Sons, Halifax.
Rice & Co. (Leeds), Ltd., Leeds, England.
G. F. Smith, Ltd., South Parade, Halifax.
Swift, George, Claremont Ironworks, Halifax.
Taylor and Challen, Ltd., Derwent Foundry, Constitution Hill, Birmingham.
H. W. Ward & Co., Lionel Street, Birmingham.
T. W. Ward, Albion Works, Sheffield.
West Hydraulic Engineering Co., 23, College Hill, London, E.C.
Winn, Charles, & Co., St. Thomas Works, Birmingham.
Yorkshire Machine Tool and Engineering Works, Liversedge, Yorks.

Marks.
Pryor, Edward, & Son, 68, West Street, Sheffield.

Metals.
Delta Metal Co., Ltd., 110, Cannon Street, London, E.C.
Magnolia Anti-Friction Metal Co., Ltd., of Great Britain, 49, Queen Victoria Street, London, E.C.
Phosphor Bronze Co., Ltd., Southwark, London, S.E.

Metals (Perforated).
W. Barns & Son, Chalton Street, Euston Road, London, N.W.

Mining Machinery.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Office Appliances.
Halden & Co., J., 8, Albert Square, Manchester.
Hall & Co., B. J., 39, Victoria Street, London, S.W.
Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.
Rockwell-Wabash Co., Ltd., 69, Milton Street, London, E.C.
Shannon, Ltd., Ropemaker Street, London, E.C.
Titan Binder Co., 31, Queen Victoria Street, London, E.C.
Trading and Manufacturing Co., Ltd., Temple Bar House, Fleet Street, London, E.C.

Oils, &c.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Wells, M., & Co., Hardman Street Oil Works, Manchester.

Packing.
Beldam Packing & Rubber Co., 93-94, Gracechurch Street, London, E.C.
Frictionless Engine Packing Co., Ltd., Hendham Vale Works, Harpurhey, Manchester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
Redfern & Co., S., Swan Lane, New Brown Street, Manchester.
Quaker City Rubber Co., Coronation House, Lloyd's Avenue, E.C.
United Kingdom Self-Adjusting Anti-Friction Metallic Packing Syndicate, 14, Cook Street, Liverpool.
United States Metallic Packing Co., Ltd., Bradford.
J. Bennett von der Heyde, 6, Brown Street, Manchester.

Paint (Metallic).
Metallic Paint Co., Ltd., Cardiff.

Paper.
Lepard & Smiths, Ltd., 29, King Street, Covent Garden, London, W.C.

Patent Agents.
Page & Rowlingson, 28, New Bridge Street, London, E.C.

Blocks, Pulleys, Crab Winches, Tackle,

Etc.

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2110 Avenue.

FLEXIBLE & SPECIAL EXTRA FLEXIBLE STEEL WIRE ROPES FOR ALL PURPOSES.

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ABSOLUTELY RELIABLE.

ROPE FOR CRANES, LIFTS, DERRICKS, &c.

STEEL WIRE ROPE,

ONE-THIRD THE WEIGHT, ONE-FOURTH THE COST OF HEMP.

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Contractors
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MINING
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HAULING PLANT
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AERIAL ROPEWAYS.

BULLIVANTS'
PATENT COMBINATION
GIN & SNATCH BLOCK.

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REGD. OFFICE:
72, MARK LANE, LONDON, ENGLAND.

Buyers' Directory—(*Continued*).

Photo Copying Frames.

J. Halden & Co., 8, Albert Square, Manchester.
B. J. Hall & Co., 39, Victoria Street, London, S.W.

Photographers.

Booker & Sullivan, 67 and 69, Chancery Lane, W.C.
Elliott & Fry, 55, Baker Street, London, W.

Photographic Apparatus.

Marion & Co., Ltd., 22, 23, Soho Square, London, W.

Pinch Bars.

Samson & Co., Garforth, near Leeds.
Stone & Co., J. B., 135, Finsbury Pavement, London, E.C.

Pipe Wrenches (Chain).

Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Pistons.

Lancaster & Tonge, Ltd., Pendleton, Manchester.

Planished Sheets.

Zeitz & Co., 21, Lime Street, London, E.C.

Porcelain.

Gustav Richter, Charlottenburg, near Berlin, Germany.

Presses (Hydraulic).

Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Publishers.

Crosby Lockwood & Son, 7, Stationers' Hall Court, London, E.C.
Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spon, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

Pumps and Pumping Machinery.

Benn, Sykes, Haslingden, near Manchester.
Drum Engineering Co., 27, Charles Street, Bradford.
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fairbanks, Morse & Co., 126, Southwark Street, London, S.E.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
J. P. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.
Tangyes, Ltd., Cornwall Works, Birmingham.

Radial Drilling Machines.

Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax.
Swift, George, Claremont Ironworks, Halifax.

Rails.

Wm. Firth, Ltd., Leeds.

Railway Wagons.

Nye, A. W., 110, Cannon Street, London, E.C.
W. R. Renshaw & Co., Ltd., Phœnix Works, Stoke-on-Trent.

Riveted Work

F. A. Keep, Juxon & Co., Forward Works, Barn Street, Birmingham.

Roofs.

D. Anderson & Son, Ltd., Lagan Felt Works Belfast.
Graham, Morton & Co., Ltd., Leeds.
Head, Wrightson & Co., Ltd., Thornaby-on-Tees.

Ropeways (Aerial).

Bullivant & Co., Ltd., 72, Mark Lane, London, E.C.

Scientific Instruments.

Cambridge Scientific Instrument Co., Ltd. Cambridge.

Spanners.

Williams, J. H. & Co., Brooklyn, New York, U.S.A.

Stampings.

Thomas Smith & Sons of Saltley, Ltd., Birmingham.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Stamps (Rubber).

Rubber Stamp Co., 1 & 2, Holborn Buildings, Broad Street Corner, Birmingham.

Stamps (Metal).

Edward Pryor & Son, 68, West Street, Sheffield.

Steam Traps.

British Steam Specialties, Ltd., Fleet Street, Leicester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Steam Wagons.

Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

Steel Tools.

Saml. Buckley, St. Paul's Square, Birmingham.
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.

Stokers.

Ed. Bennis & Co., Ltd., Bolton, Lancs.
Meldrum Brothers, Ltd., Atlantic Works, Manchester.

Stone Breakers.

S. Pegg & Son, Alexander Street, Leicester.

Superheaters.

A. Bolton & Co., 40, Deansgate, Manchester.

Time Recorders.

Howard Bros., 10, St. George's Crescent, Liverpool, and 100C, Queen Victoria Street, London, E.C.
Recorders, Ltd., 171, Queen Victoria Street, London, E.C.

Tubes.

Premier Boiler Tubes, Ltd., 28, Victoria Street, London, S.W.
Thomas Piggott & Co., Ltd., Spring Hill, Birmingham.
Tubes, Ltd., Birmingham.

Turbines.

G. Gilkes & Co., Ltd., Kendal.
Greenwood & Batley, Albion Works, Leeds.
S. Howes, 64, Mark Lane, London, E.C.

Typewriters.

Elliott-Fisher Co., 85, Gracechurch Street, London, E.C.
Empire Typewriter Co., 77, Queen Victoria Street, London, E.C.
Yost Typewriter Co., 50, Holborn Viaduct, London, E.C.

Valves.

Holmes & Co., W. C., Huddersfield.
Scotch and Irish Oxygen Co., Ltd., Rosehill Works, Glasgow.
Shaw, Joseph, Albert Works, Huddersfield.
Winn, Charles, & Co., St. Thomas Works, Birmingham.

Ventilating Appliances.

Matthews & Yates, Ltd., Swinton, Manchester.

Wagons—Steam.

Thornycroft & Co., J. I., Ltd., Chiswick, London, W.

Water Softeners.

Lassen & Hjort, 52, Queen Victoria Street London, E.C.

Weighing Apparatus.

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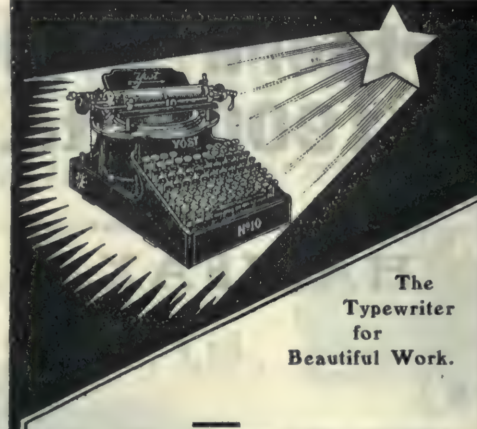

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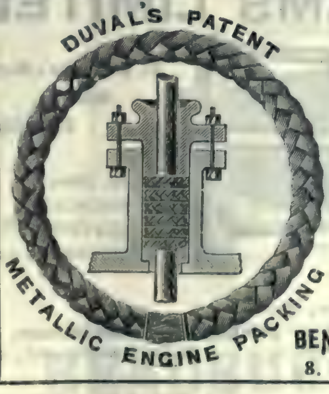

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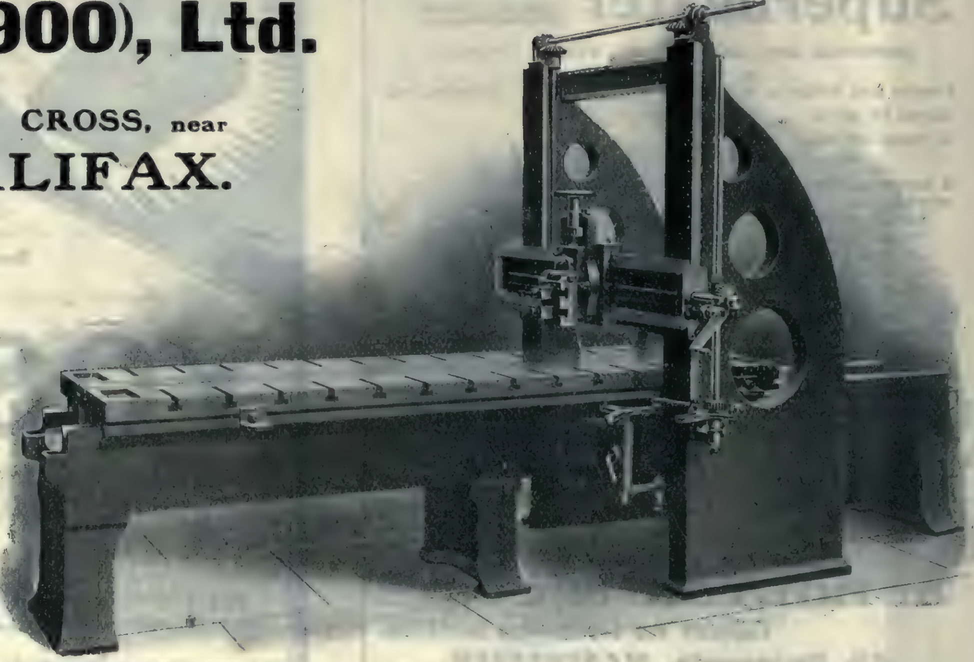

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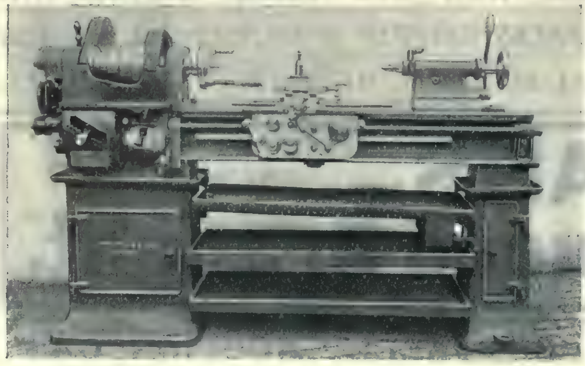

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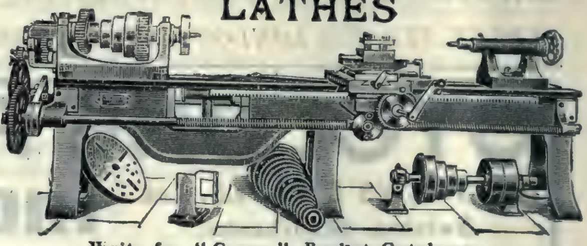

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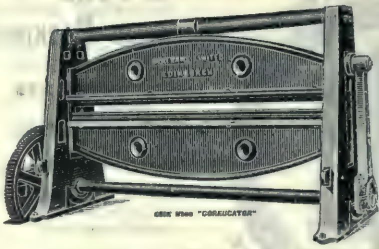

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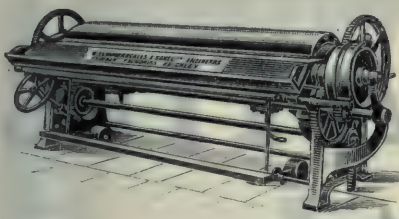

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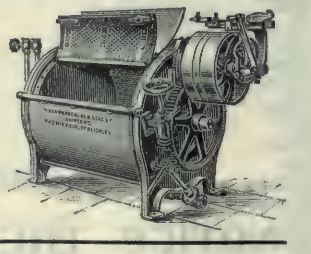

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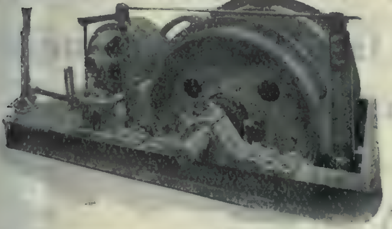

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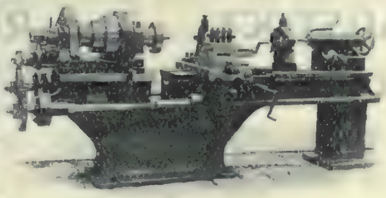

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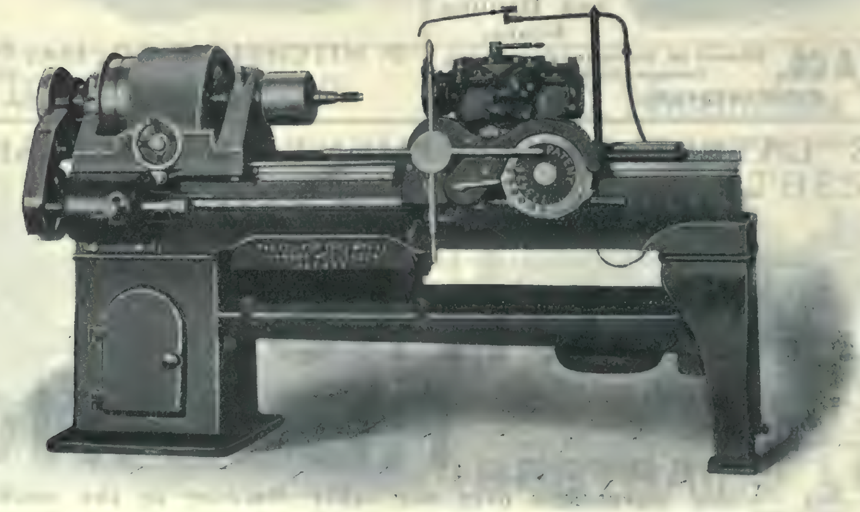

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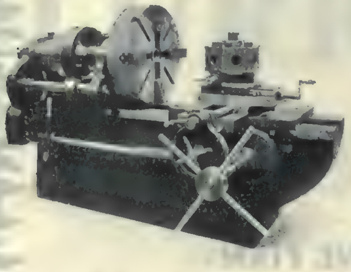

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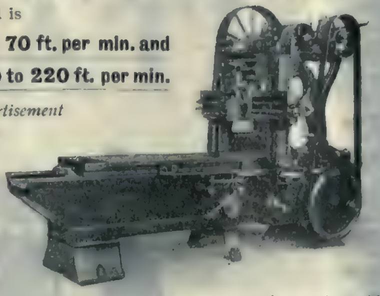

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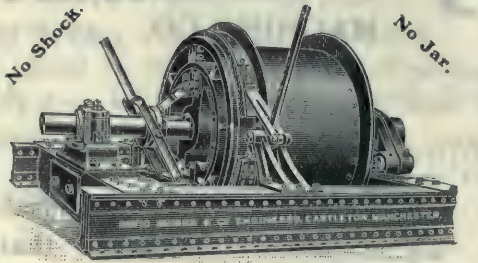
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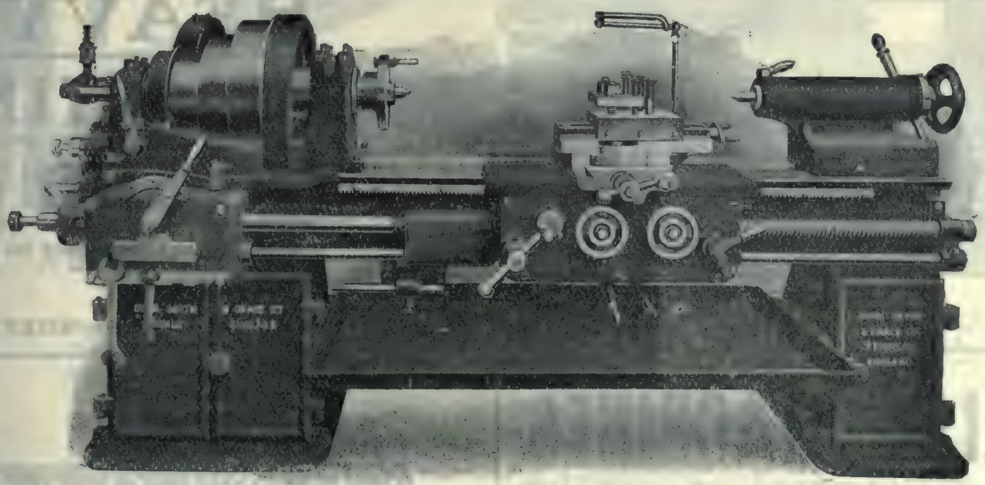

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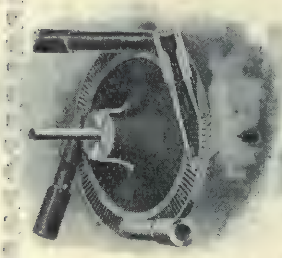

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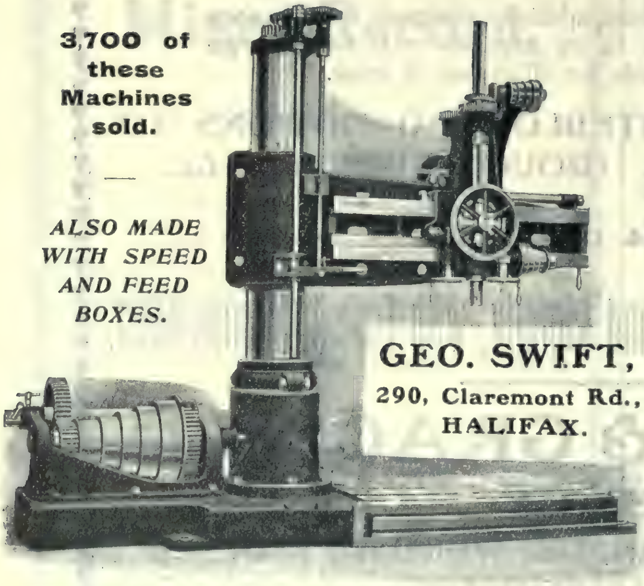

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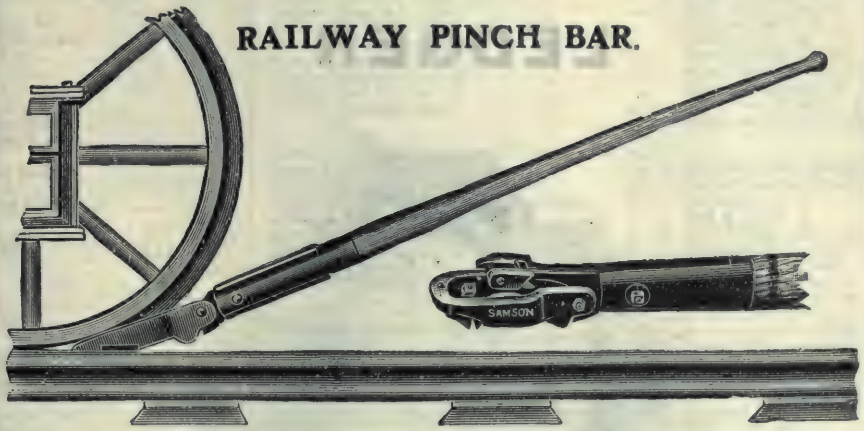

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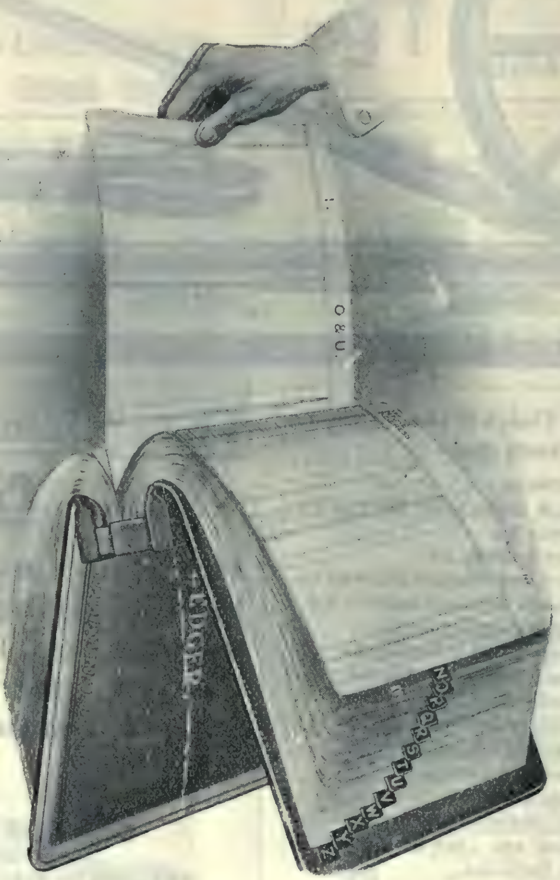
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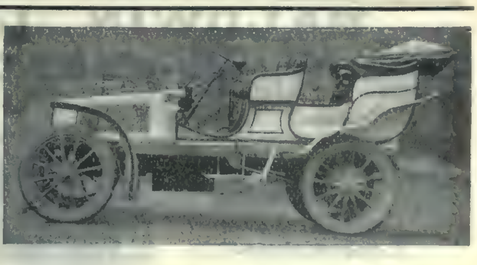

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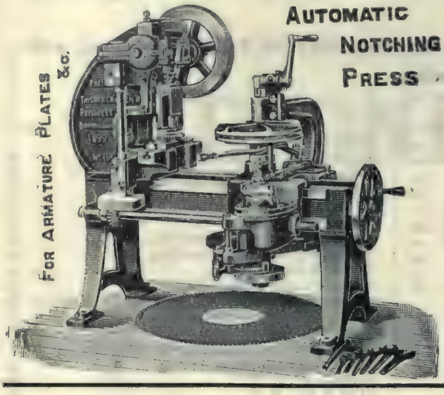

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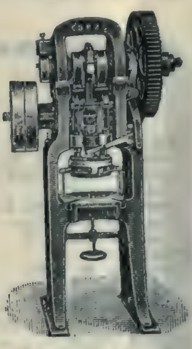

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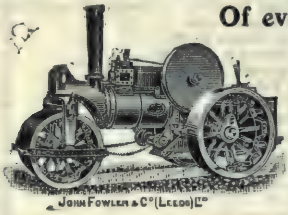
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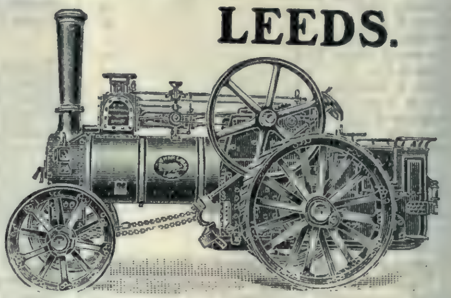

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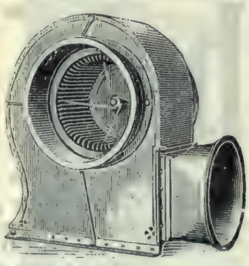

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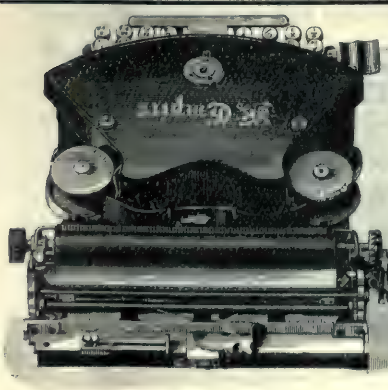

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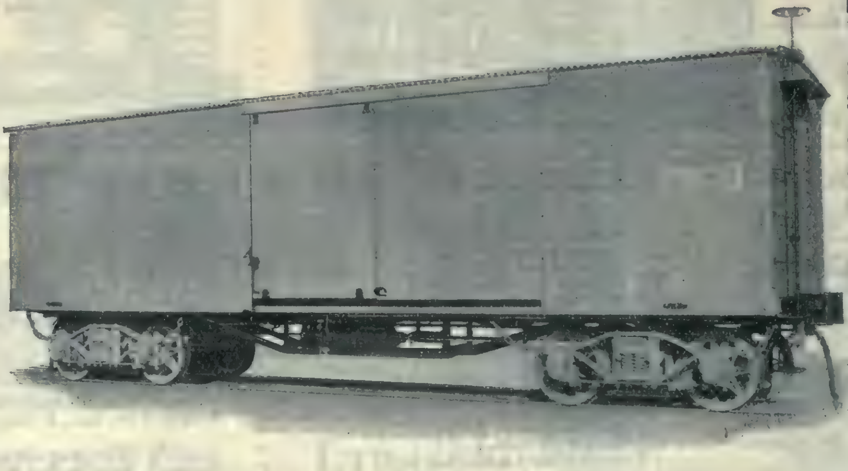

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PAGE'S WEEKLY

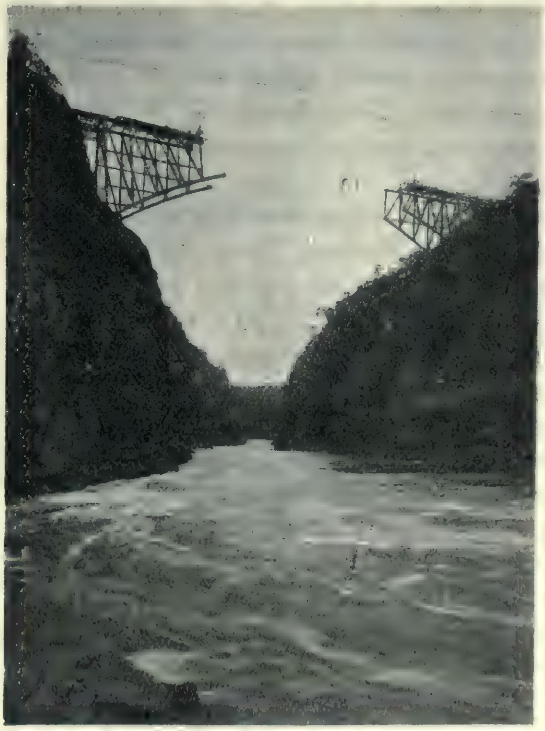
An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

Vol. VI. LONDON, FRIDAY, APRIL 7, 1905. No. 30.

The Offices of "Page's Weekly," Wednesday Evening.

THE engineers of the British South Africa Company—Sir Douglas Fox and Partners—announced that the great bridge over the gorge at the Victoria Falls, on the Zambesi River, was linked up at 7 o'clock on Saturday morning, in the presence of Sir Charles Metcalfe, consulting engineer in Rhodesia. The two ends of the bridge had, from the necessities of the case, to be projected gradually from either cliff across the gorge. The slightest deviation from a just level would have caused great difficulties, and the satisfaction is the greater that this delicate feat of engineering has been well and truly accomplished, thus completing one of the most important links in the Cape to Cairo route. The accompanying illustration of the bridge in an earlier state is reproduced by courtesy of the African World from a photo specially taken for that journal. It shows the bridge as seen from the famous "Boiling Pot." The bridge is the highest in the world. The Victoria Falls are approximately a mile wide, by 420 feet high, as compared with Niagara's depth of 158 feet.

The motor-omnibus ought to do a good deal towards reconciling the man in the street to the motor-car. For a small fee it will carry him into almost inaccessible country places from the railway termini, or he can be hurried across London at a rate which places the horse omnibus altogether at a discount. The London companies are taking up the motor-'bus with avidity. Clarkson's steam omnibus, as supplied to the London Road Car Company and the London General Omnibus Company, works with a special and highly commendable freedom



THE BRIDGE OVER THE GORGE AT VICTORIA FALLS.

from smell and noise. A single-deck steam-'bus is worth £826, while a double-decker costs as much as £950. The London General Omnibus Company, Thomas Tilling, Ltd., the Atlas and Waterloo Omnibus Association, and others have extensively patronised the Milnes-Daimler 'bus, and the London Road Car Company have ordered over fifty omnibuses from the Motor Car Emporium, Ltd., while the Straker-Squire omnibus is also being freely taken up by the various omnibus companies. Messrs. John I. Thornycroft and Co., Ltd., and other engineers are now turning their attention to this form of motor construction with marked success. These roomy and comfortable vehicles are constructed to carry as many as thirty-six passengers. They are now an every-day part of the London traffic, and have evidently come to stay.

Students of electrical engineering are in these days too often encouraged to view their prospects through deluges of cold water. If this paragraph meets the eye of any young man who has persuaded himself that the profession is hopelessly overcrowded, the following remarks, which recently appeared in an electrical contemporary, may prove suggestive and stimulating: Every branch of engineering has its unsolved problems to-day, and particularly does this apply to electrical work. Transatlantic telephony is still to be realised. Innumerable water powers the world over await the development which the presence of a market sets in motion. The storage battery has far from captured the automobile for long-distance travel. The telegraph still does a duplex and quadruplex business instead of a multiplex transmission. Railway signalling is capable of being greatly improved, particularly on trolley roads. The power house bristles with differences of opinion as to apparatus and systems advisable, and the sub-station stands at the threshold of great changes in design. The production of electrical energy direct from coal challenges the ablest minds of modern times. Wireless telegraphy, the electrification of steam railway suburban service, and the development of certain inter-urban lines with alternating-current motors stand as open doors of opportunity to the electrical engineer. Industrial chemistry calls for electrical assistance as never before. The freight traffic of steam railways still remains loyal to the steam locomotive and challenges the best electrical engineers of the transportation field to capture it. Finally, the operation of all the electrical enterprises thus far developed opens a permanent field for the abilities of innumerable engineers. The growing appreciation of the business side of technical work is one of the brightest signs of the times. Opportunities for eliminating waste and misdirected labour are never wanting. If every branch of electrical science were applied to the capacity of civilisation to receive its application, there would still remain the great field of operation as a promising outlook for electrical engineers.

Apropos of the article on American locomotives, which appears elsewhere in this issue, we take the opportunity of referring to the paper which Mr. William Pollard Digby read last Monday before the Society of Engineers on "Statistics of British and American Rolling Stock." A great many interesting tables are given, from which we have only space to reproduce three. The figures in Table I. show a greater locomotive density in the United Kingdom than in the United States. A denser population together with a greater mileage open for traffic per 1,000,000 inhabitants is the natural cause of this. The total number of locomotives within the United Kingdom has increased by slightly over 22 per cent. in ten years, and the number in the United States by slightly under 19 per cent. in nine years. Table II. indicates that the number of passenger engines have but slightly increased (about 4 per cent. in nine years), while the goods engines have increased 7 per cent., and the shunting or switching engines—as they are termed in the United States—32 per cent. Figures are also given showing that in America at any rate the compound locomotive is greatly appreciated on account of its superior hauling powers. While Table I. shows that the increase in the number of locomotives in America in eight years is only 0·03 per mile, as against an increase in the United Kingdom of 0·12 per mile, Table IV. shows the remarkable extent in which the Americans are endeavouring to get the uttermost out of their locomotive rolling stock. While the number of locomotives has only increased slowly, the number of passengers and tonnage of freight carried has increased enormously.

———

The British engineer who, in the columns of an Indian contemporary, recently characterised the much advertised superiority of American manufactures over British as a "pure myth" did something more than deal in generalities. He cited instances within his personal knowledge tending to show that when efficiency and sound workmanship are desiderata worth considering, there is no machinery to equal, much less surpass, the products of British shops. Ill-considered speeches by politicians are, no doubt, largely responsible for the depreciation of British manufactures. A political speech to catch the popular ear must be racy and pungent, and it is as easy to sound the alarmist note as it is to blow one's own trumpet. According to these prophets the British manufacturer is decadent and practically "done for" *unless* something or other; yet, strange to say, he is too busy as a rule to bother about his supposed impending doom, and if his customers are temporarily led astray by the glamour of preposterous promises, somehow or other he generally sees them again.

One of the instances in point is quoted by "British Engineer" concerning a certain city corporation in Scotland who wanted engines for electrical generation. They were told that they must go to America and they believed it, with the result that the order was given to an American firm. Eventually, after some unpleasantness, the order was withdrawn and

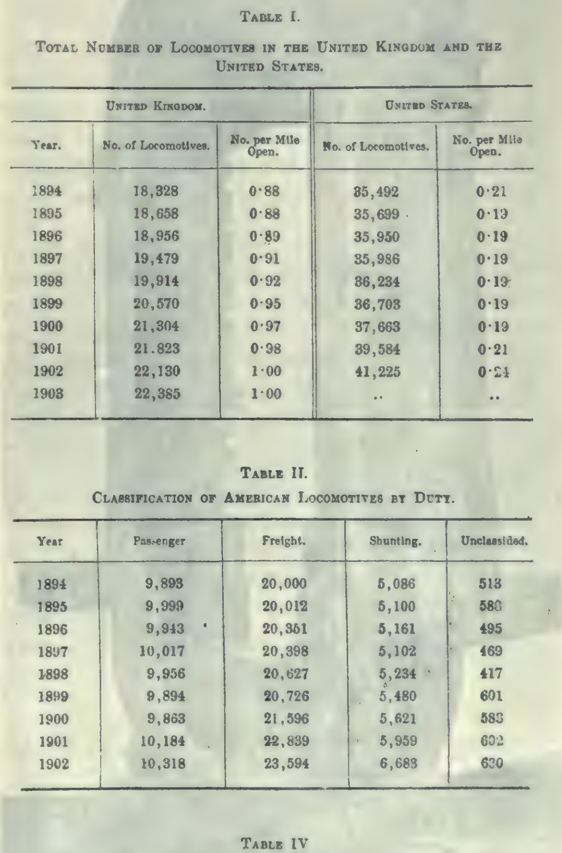


TABLE I.

TOTAL NUMBER OF LOCOMOTIVES IN THE UNITED KINGDOM AND THE UNITED STATES.

	UNITED KINGDOM.		UNITED STATES.	
Year.	No. of Locomotives.	No. per Mile Open.	No. of Locomotives.	No. per Mile Open.
1894	18,328	0·88	35,492	0·21
1895	18,658	0·88	35,699	0·19
1896	18,956	0·89	35,950	0·19
1897	19,479	0·91	35,986	0·19
1898	19,914	0·92	36,234	0·19
1899	20,570	0·95	36,703	0·19
1900	21,304	0·97	37,663	0·19
1901	21.823	0·98	39,584	0·21
1902	22,130	1·00	41,225	0·24
1903	22,385	1·00	..	..

TABLE II.

CLASSIFICATION OF AMERICAN LOCOMOTIVES BY DUTY.

Year	Passenger	Freight.	Shunting.	Unclassified.
1894	9,893	20,000	5,086	513
1895	9,999	20,012	5,100	588
1896	9,943	20,351	5,161	495
1897	10,017	20,398	5,102	469
1898	9,956	20,627	5,234	417
1899	9,894	20,726	5,480	601
1900	9,863	21,596	5,621	583
1901	10,184	22,839	5,959	602
1902	10,318	23,594	6,683	630

TABLE IV

ASSIGNMENT OF LOCOMOTIVE EQUIPMENT TO AMOUNT OF TRAFFIC.

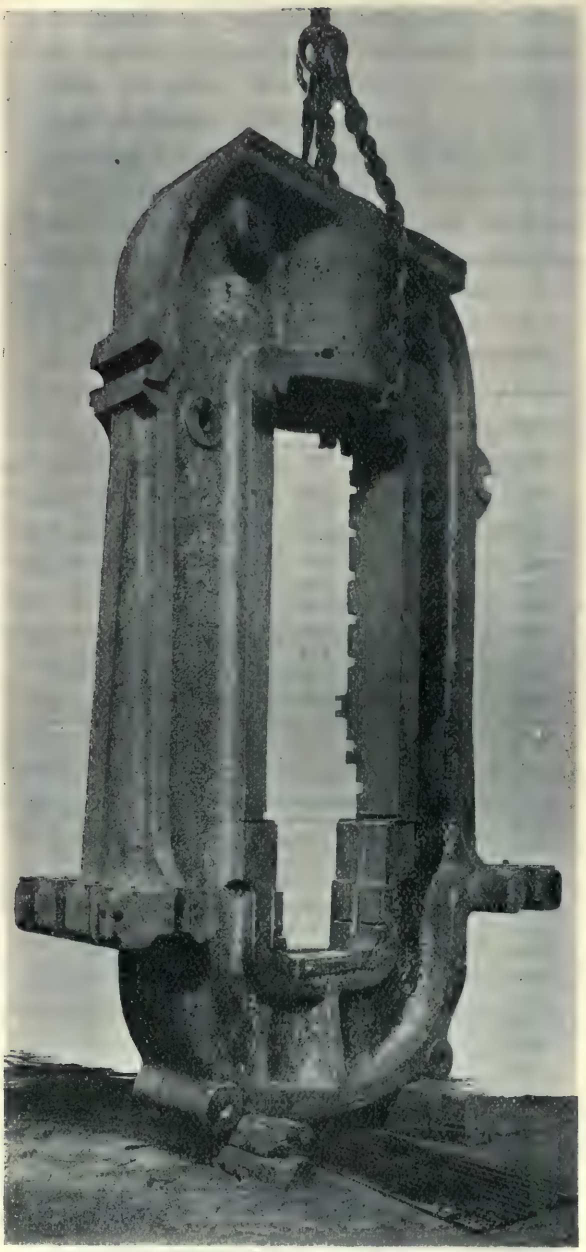
Year.	Passengers carried per Passenger Locomotive.	Passenger Miles per Passenger Locomotive.	Tons carried per Freight Locomotive.	Ton Miles per Freight Locomotive.
1894	54,564	1,444,400	31,909	4,016,755
1895	50,747	1,218,967	34,817	4,258,821
1896	51,741	1,312,381	37,634	4,684,210
1897	48,861	1,223,614	36,362	4,664,135
1898	50,328	1,348,906	42,614	5,530,498
1899	52,878	1,474,765	46,303	5,966,193
1900	58,488	1,626,179	51,013	6,556,731
1901	59,631	1,704,005	47,692	6,439,736
1902	62,985	1,908,310	50,874	6,666,499

STATISTICS OF AMERICAN AND BRITISH ROLLING STOCK.

divided between the American firm and a Lancashire firm, the reasons for the division being that the Lancashire firm could not guarantee to deliver within the time specified. The engines were of such a large horse-power that no firm in England had the necessary buildings for their erection. The Lancashire firm had to build a new erecting shop and enlarge their foundry to cope with the order, and in spite of all these drawbacks it was the Lancashire engine that was put first to work, yet the American firm said that they supplied things like these from stock. The Lancashire engine came out 50 per cent. better in the governing results than was asked for, although by the accurate governing specified it was thought no British firm could compete.

* * *

Another notable instance was in connection with the South African bridges destroyed during the war. The usual claim was made by the American Press that their manufacturers supplied small things like the South African bridges from stock. The Wednesbury Axletree and Pulley Company signed a contract for one of the bridges on the last day of the old year. "The bridge was in five sections of 105 feet length each. The stipulation was that the first section was to be delivered at the docks for shipment on February 1st following date of signing. This firm *did not* stock bridges, nor had they in stock a single bar of iron of the right section. They had to roll the iron and build the bridge, and instead of delivering the first section they delivered all five sections some days within the time specified for the first section. Nothing was heard of it, no comments published in the newspapers to chronicle where our engineers surpass American, but if this splendid result had been achieved by an American firm it would have been published broadcast and quoted as showing where we were lagging behind America."



A 16-FT. 3-IN. STEEL HOUSING.

The above illustration shows one of a pair of housings for a 110-in. plate mill. It weighs 52,920 lb., and is 16 ft. 3 in. high by 11 ft. 1½ in. wide. Tests showed a tensile strength of 70,000 lb. The housing was cast in a mould with two gates, the steel being poured simultaneously from two bottom-pour ladles. It was made for the Morgan Engineering Company by the Union Steel Casting Company, of Pittsburg, to whom we are indebted for the photograph.

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

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New Copy for Advertisements,

Alterations, &c., intended for insertion in the current week's issue must be delivered **not later than 4 p.m. on Monday.** If proofs are required the copy and blocks should reach us several days earlier.

MEETINGS FOR THE ENSUING WEEK.

FRIDAY, APRIL 7th.—Royal Institution, 9 p.m.: "American Industry, Mr. James Moseley.—Institution of Civil Engineers, Great George Street, 8 p.m.: Papers—"Cofferdams for Dock Use," R. G. Clark, Stud.Inst.C.E.; "Bath Corporation Waterworks Extensions," J. R. Fox, Stud.Inst.C E.—Junior Institution of Engineers, Westminster Palace Hotel, 8 p.m.: Paper, "Practical Notes on Waterworks Construction,' Mr. George H. Hughes.

SATURDAY, APRIL 8th.—North of England Institute of Mining and Mechanical Engineers.—Royal Institution, 3 p.m.

MONDAY, APRIL 10th.—Institute of Marine Engineers, Stratford, 8 p.m.—Institution of Civil Engineers: The thirteenth "James Forrest" lecture will be delivered by Colonel Crompton, "Unsolved Problems in Electrical Engineering."—Royal Geographical Society, 8.30 p.m.

TUESDAY, APRIL 11th.—Royal Colonial Institute, Whitehall Rooms, 6.30 p.m.—Royal Institution, 5 p.m.: Mr. Percival Landon on "Thibet."—Royal United Service Institution, 3 p.m.—Institution of Electrical Engineers (Manchester Local Section), Owens College, 8 p.m.: General Meeting.

WEDNESDAY, APRIL 12th.—Society of Arts Ordinary Meeting.—Institution of Electrical Engineers, Birmingham Local Section—Glasgow Local Section.—Institution of Naval Architects: Annual meeting in Hall of Society of Arts.

THURSDAY, APRIL 13th.—Institution of Naval Architects.—Institution of Electrical Engineers, Great George Street, S.W., 8 p.m.; Dublin Local Section, Royal College of Science, Dublin; Leeds Local Section.—Institution of Mechanical Engineers: Anniversary Dinner at Hotel Cecil.—Institution of Mining and Metallurgy, Burlington House, 8 p.m.: Discussion on papers.

FRIDAY, APRIL 14th.—Institution of Naval Architects.—Physical Society, 8 p.m.—North-East Coast Institution of Engineers and Shipbuilders, Newcastle.—Institution of Mechanical Engineers, Storey's Gate, 8 p.m.: Resumed discussion on report to Steam Engine Research Committee.—Royal Institution, 9 p.m.: Lord Rayleigh on 'The Law of Pressure of Gases below Atmosphere."

NEWS ITEMS.

The Great Northern Railway Company have ordered two "Avonside" Steam Railway Motor Cars, from The Avonside Engine Company, Fishponds, Bristol, for delivery for summer traffic.

An extensive sale of obsolete war and other vessels was conducted at Chatham Dockyard on Tuesday by Messrs. Fuller, Horsey, Sons, and Cassell. The majority of the ships were sold subject to their being broken up. The total of the sale was about £138,000.

The largest deal in the history of the iron and steel trade has been consummated during the week by the sale of 200,000 tons of Bessemer and open-hearth billets to Pittsburg Steel Company by the United States Steel Corporation and the Republic Iron and Steel Company. The price is given as $20 per ton.

The new bridge, which has been constructed across the river Exe, at Exeter, at a cost of about £25,000, has been formally opened. The structure was designed by Sir J. Wolfe-Barry and Mr. C. Brereton, and has been erected under their supervision. Mr. J. Stokes, chairman of the bridge committee, said he believed that it was the first pin-bridge erected in England.

Mr. W. B. Parsons, the chief engineer of the New York Board of Rapid Transit Commissioners, recently had the unusual experience of reading in an English journal that he had just died. Now an Indian contemporary confuses him with the Hon. Charles A. Parsons. In expressing its regret for this the journal in question says "Peccacimus." It is human to err.

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Gorton Destructor.

The contract for a new four-cell Horsfall Destructor at Gorton, Manchester, capable of burning sixty tons of refuse in twenty-four hours, was sealed on July 14th, 1904, and the work of erection commenced on August 20th, 1904. The works were completed in five months, and drying fires were lit on January 30th, 1905, so that the contractors were well within their time limit of six months. The site chosen for the destructor is land belonging to the corporation adjoining the sewage works and pumping station.

The cells, or destructor furnaces, are of the standard "Horsfall" type, each furnace having a grate area of 42 square feet, or 168 square feet to the four cells. Each cell is provided with a drying hearth situated within the furnace itself, and on this hearth the preliminary drying of the refuse takes place, the fumes from this process being cremated by passing over the hottest part of the fire, and then conducted away by a special flue arrangement by which the whole products of combustion are exposed to intense heat.

Each furnace is provided with forced draught, so ensuring a high temperature in the cell and accelerating rapid combustion. A recent improvement which needs special mention is the automatic blast cut-off. When the fireman wishes to clinker his fire, he opens the clinker door, and in so doing cuts off the supply of steam to the jets, a rod being fixed from the quadrant to the valve, and as the door opens it closes the valve and cuts off the steam, which is, of course, turned on again as the door is closed. The air for the blast is brought in through the patent cast-iron side boxes; the steam jet blowers are fixed in such a manner as to draw the fumes from the upper part of the furnace arch. These side boxes serve a double purpose, *i.e.*, protecting the side walls immediately above the grate bars, and at the same time heating the air, and so providing a hot blast.

Over each furnace there is a cross flue inside the furnace, to the left of the clinkering door arch, and through this flue the fumes and gases are conveyed to the combustion chamber, which is situated inside the block of cells. The heat in this combustion chamber is maintained at a white heat, or a temperature of 2,000 deg. F. to 2,500 deg. F., and thus it is an absolute impossibility for any noxious fumes, gases, or the like to gain access to the chimney. The hot gases are then taken to the Babcock and Wilcox boiler, which is of 870 square feet heating surface, working at a pressure of 120 lb. to the square inch, and from thence to one of the Horsfall Company's centrifugal dustcatchers (Accrington type) and into the chimney. The dustcatcher prevents absolutely any possible escape of dust from the top of the chimney shaft. Space has been provided for a second boiler, should the council decide to put another down at any future date.

The clinker from the furnaces is placed in buckets or hoppers suspended from an overhead railway (on Messrs. Cox and McTaggart's patent system), secured to the backstays along the front of the furnaces, and supported outside the building on strong iron trestles. The buckets are constructed entirely of steel, with a capacity of about 10 cubic feet, each hung on self-tipping trunnions attached to vertical suspension rods and connected again to a carriage with flanged wheels running on the rail; the whole is arranged so that the clinker can be pulled right out of the furnace into the tube and taken and tipped anywhere within range of the railway.

A massive mortar mill of the Horsfall Destructor Company's own make, specially designed for dealing with hard clinker from high temperature destructors has also been included in the plant. The surplus heat from the destructor will be taken advantage of by the sewage works for driving an air compressing engine for raising the sewage; while the clinker when crushed and ground and screened will be used for the filter beds, thus effecting an immense saving in coke.

The new works have been carried out under the supervision of the council's consulting engineer, Mr. Charles J. Lomax, of Manchester. The contractors for the destructor cells, boiler, flues, dustcatcher, etc., were the Horsfall Destructor Company, Ltd., of Leeds; the buildings and chimney, the latter 120 ft. in height, being carried out by a local firm of builders to Mr. Lomax's drawings and specifications.

The Iron and Steel Market.

The Iron and Steel market is still suffering from the effects of a tired bull account, but the news that a large quantity of hematite iron has been sold and will be shipped to America had, says Merton and Co's circular, a strengthening effect upon the speculative market. Messrs. Robert Katz and Co.'s circular points out that iron continues to go into store and under the present conditions of trade and at the price now ruling, the over-production looks like going on, unless America takes far more than she shows signs of doing at present Pig-iron warrants are however active and firm on strong American support, and large dealings in Cleveland to the extent of 20,000 tons are being reported. The latest prices of Middlesbrough is 49s. 1d. cash, and 49s. 3d. one month.

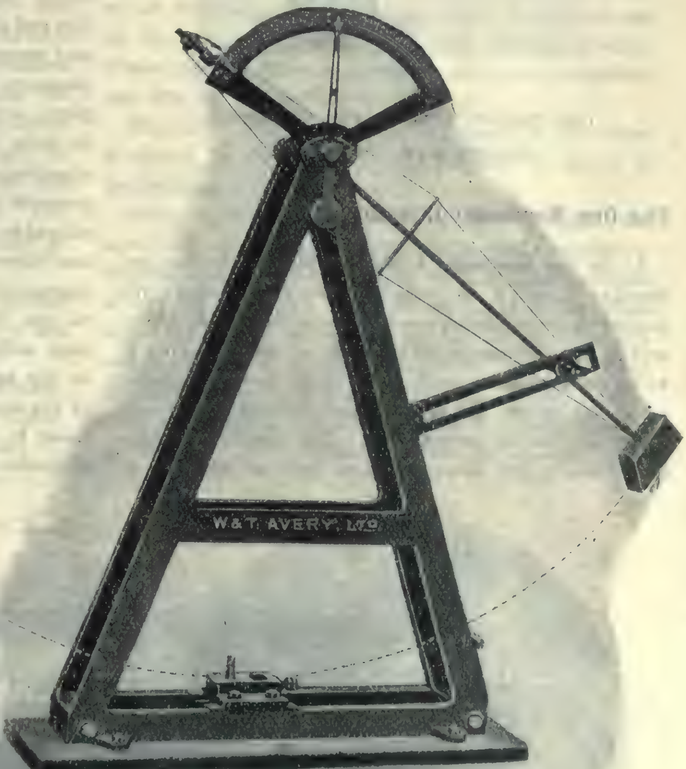
The death is reported, from Chorley, of Mr. Charles Gidlow Jackson, one of the most prominent men in Lancashire mining circles.

The Motor Launch "Champak."

The *Champak* is a useful type of motor launch for any kind of emergency purposes. It has a speed of eighteen miles per hour, and is employed by the military authorities at Gravesend in connection with their torpedo aiming practice. A representative of PAGE'S WEEKLY had recently an opportunity, by the courtesy of the builders (Messrs. John I. Thornycroft and Co., Ltd.), of watching the training of the Oxford and Cambridge crews from one of these launches. The *Champak* has a four-cylinder engine, the bore and stroke of which are 6 in. and 8 in. respectively. This engine running at 800 revolutions per minute develop 55 h.p. The reversing gear and clutch is of the multiple friction disc type, while the propeller, which is of gun metal, is specially designed for this type of boat. The price of this boat complete with engine is £820, the engine, reversing gear propeller and fittings being £546.

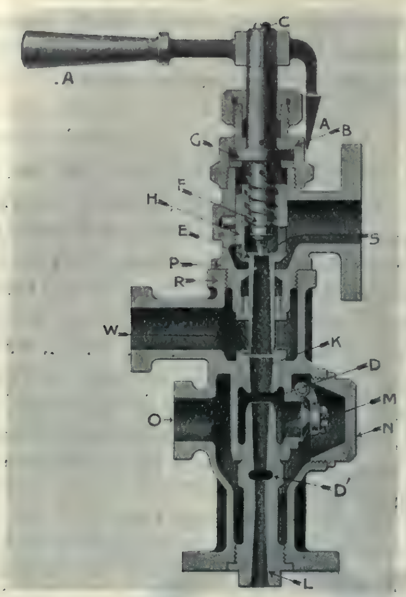
Avery's Patent Impact Testing Machine.

The importance of testing by impact has been a good deal discussed lately, and impact testing is undoubtedly essential when any material is required to stand "shock," it being impossible to find out this quality by tensile or any other than impact test. The impact testing machine illustrated herewith has been designed to meet this demand. A pendulum weight is raised to a certain height and allowed to swing and strike the test piece, fracturing it in one blow, and the number of foot pounds of energy which the test piece has absorbed is automatically registered on the indicating quadrant. The advantage accruing from a machine which will apply a sudden "shock" and accurately register the amount of energy which the test piece absorbs at fracture cannot be exaggerated. The fractures made show agreement with the microstructures, and enable the expert to determine the carbon contents of the specimen and its previous thermal treatment. The makers, Messrs. W. and T. Avery, Ltd., state that manufacturers are able to test the various samples of materials offered for specific purposes on this machine at a very rapid rate. The machine can be worked by an unskilled operator.



AVERY'S IMPACT TESTING MACHINE.

Mr. C. J. Steinhart, Ph.D., F.C.S., and Mr. J. L. F. Vogel, M.I.E.E., M.I.M.M., hitherto working as Steinhart and Vogel, at 91, Blackfriars-road, London, S.E., as technical chemists and metallurgists, and also as managing directors of the Tungsten and Rare Metals Company, Ltd., have entered into an arrangement with Mr. T. C. Cloud, A.R.S.M., F.I.C., F.C.S., late manager of the Wallaroo Smelting Works, South Australia, to amalgamate their businesses, and in future, the joint firm will be known as Steinhart, Vogel and Cloud. Their office will be at 4, Lloyd's Avenue, Fenchurch Street, E.C.



ONE MOVEMENT INJECTOR BY MESSRS. HOLDEN AND BROOKE, LTD.

The One Movement Injector.

In the one movement injector of Messrs. Holden and Brooke, Ltd., it is only necessary to bring the pointer A (vide illustration) opposite the figure representing the existing boiler pressure on the scale ring B to set the injector to work. This single movement turns on steam, starts the injector and adjusts steam and water supplies in correct ratio. The means by which these results are brought about will be understood on reference to the cross section, and following description which we quote from an informing little work on "Locomotive Injectors" recently published by the Locomotive Publishing Company, Ltd. :—

"The steam nozzle projects upwards and forms the 'nut' of the regulating spindle, to which is attached the controlling handle. Axial motion of the spindle is prevented by the collar at the upper part immediately under the gland, and the steam nozzle can slide up and down but is restrained from rotation by the feather key seen in the illustration. The end of the spindle is coned, and in the non-working position of the regulating handle acts as a stop valve to the steam nozzle. As soon as the handle is turned to start the injector, the spindle is lifted off its seating, admitting steam to the nozzle. As the spindle is rotated the steam nozzle is lowered so that at any position of the handle the correct relation exists between the steam nozzle area and the combining cone inlet. The end of the handle is turned down to act as a pointer, and moves over a scale graduated for varying boiler pressures, the thread of the spindle having a quick pitch, a slight turn of the handle is all that is necessary to bring the pointer over the mark on the scale corresponding to the boiler pressure available. If the boiler pressure is low, the handle is turned through a considerable arc which gives a large opening to steam and decreases the water inlet. If the latter were not decreased a large quantity of water would enter owing to the high vacuum, more than the injector could deal with, and waste would take place at the overflow or the apparatus would knock off. The pressure range of the injector is 15lb. to 180lb., and if desired it can be made to work up to 200lb., or for a higher range of pressures up to 300 lb.'

THE MOTOR LAUNCH "CHAMPAK."

Length, 40 ft. Beam, 6 ft. Draft, 2 ft. 3 in. Speed, 18 miles

ALLOYS OF COPPER AND BISMUTH.

AT a meeting of the Faraday Society held on Tuesday last, Mr. A. H. Hiorns read a paper on this subject, of which the following is an abstract:—

The alloys were all made in a carbon crucible, melting the copper first and then adding the bismuth. Two sets of alloys were made, one of which was cooled very slowly, and the other very quickly, in order to ascertain the difference of structure, if any, by the different rates of cooling. By slow cooling out of contact with air, the surface structure can be clearly seen and examined, so that a comparison can be made between the external and the internal structure after polishing. The ingredients of each alloy were carefully weighed, so as to make an ingot of 700 grains in each case. The alloys were also accurately weighed after cooling so as to determine any loss that might be experienced in the operation. By the method adopted most of the alloys came out dead weight, which obviated the necessity of analysis. A portion was cut from each alloy right through the ingot and set aside for micro-examination. The rest was used for the pyrometric determination. The surface selected for polishing was generally that at right-angles to the cooling surface.

The alloys of copper and bismuth have been studied by Arnold, but he confined his experiments to 0·5 and less per cent. of bismuth.

Dr. Gautier with a curve similar to that of the author, although his temperatures were generally higher, states that there are two eutectics, one at 243 deg. C., and another at 887 deg. C. He does not show any eutectic at 1,020 deg. C., and the fact is of considerable importance.

CURVE OF FREEZING POINTS.

The microscopic evidence mainly confirms the records of the freezing-point curves, of which there are four branches, AB, BC, CD, and DE.

There is pure copper, at E, fig. 1; pure bismuth at A.; and solution of copper in bismuth, or bismuth in copper at all intermediate points. The types of pattern on the etched surfaces depend on the position of the freezing points on the curve. The eutectic points occur at 243 deg. C., 858 deg. and 1,020 deg. C. Any deviation from these points causes the breaking-up of the characteristic structure, and crystals of one of the constituents appear in the eutectic matrix. These crystal grains are primary bodies, they crystallise out first on the cooling of the alloy.

The curve recording the freezing points of the alloys is shown in fig. 1. The composition is given in percentages.

From A, the freezing point of pure bismuth, the curve falls with addition of copper, until the composition reaches about 97 per cent. of bismuth, at a temperature of 245 deg. C., which is the lowest point of the whole series and marks the eutectic mixture of pure bismuth and a solution of copper in bismuth. As the copper is increased beyond 3 per cent. the curve rapidly rises, and with 5 per cent. reaches a temperature of 600 deg. C. After this the curve rises less abruptly, and

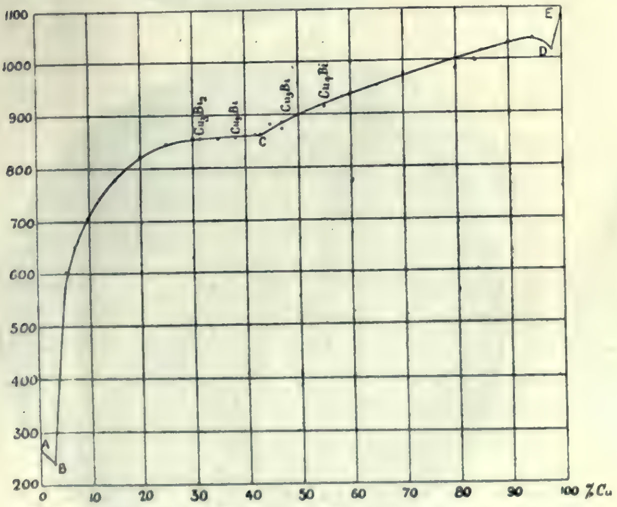


Fig. 1.—Freezing-Point Curve of Copper-Bismuth Alloys.

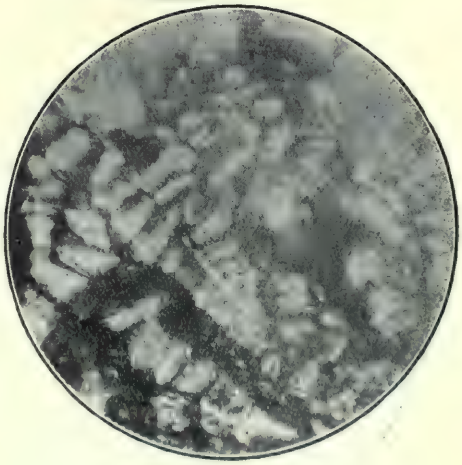


Fig. 2.—5 per cent. Bismuth.

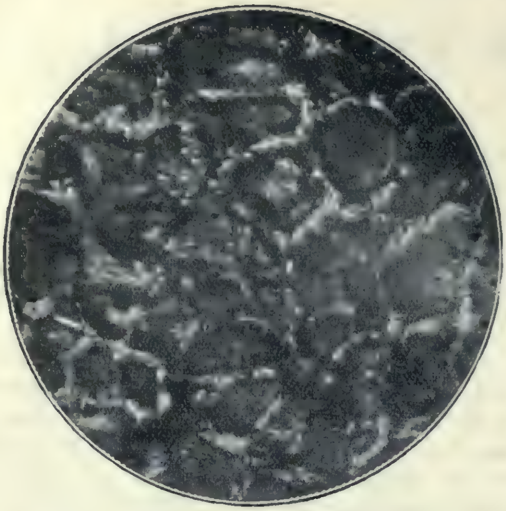


Fig. 3. 45 per cent. Bismuth.

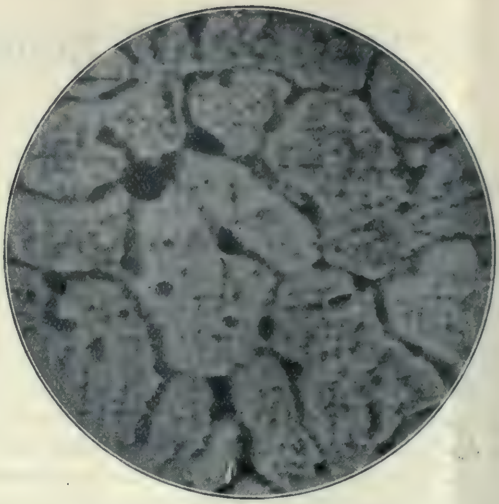


Fig. 6. 4 per cent.

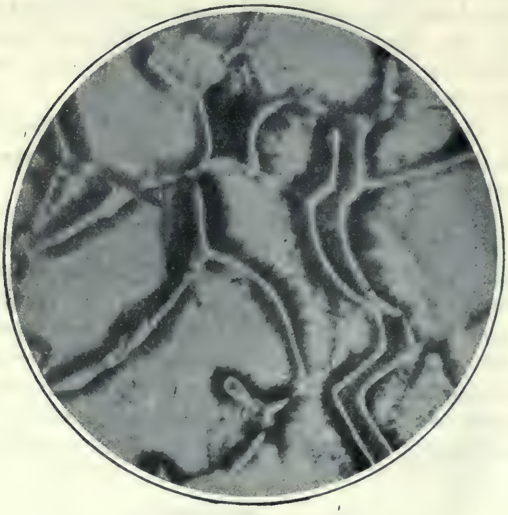


Fig 4. 0·4 per cent.

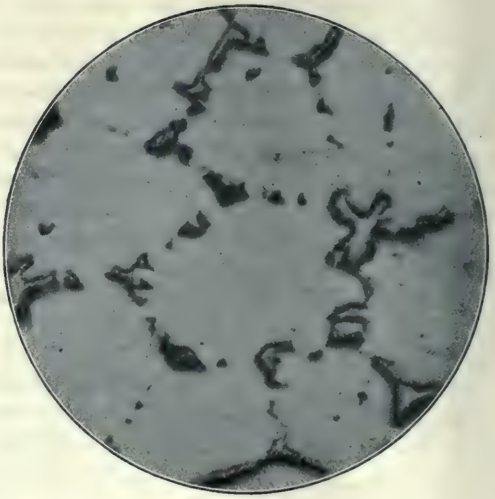


Fig. 7. 10 per cent

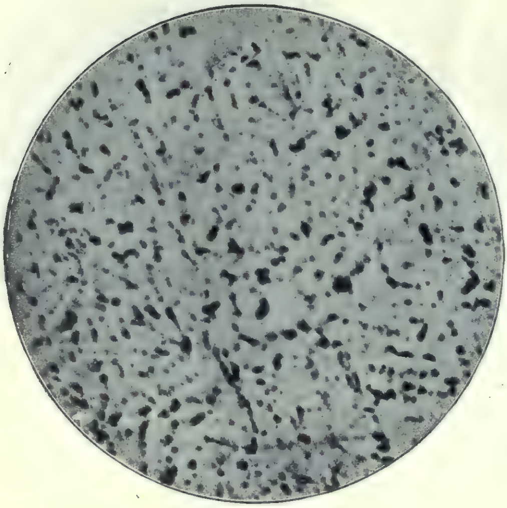


Fig. 5. 2 per cent.

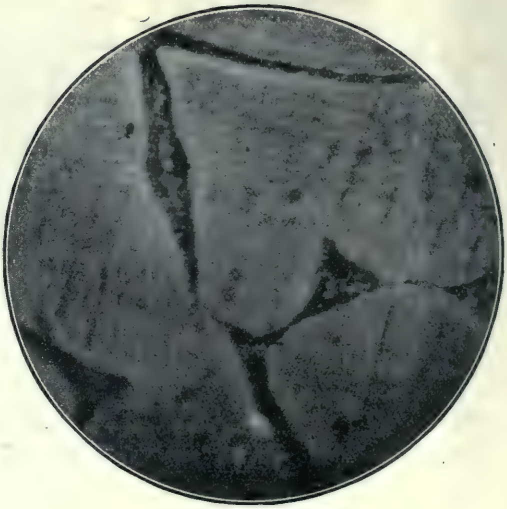


Fig. 8. 25 per cent.

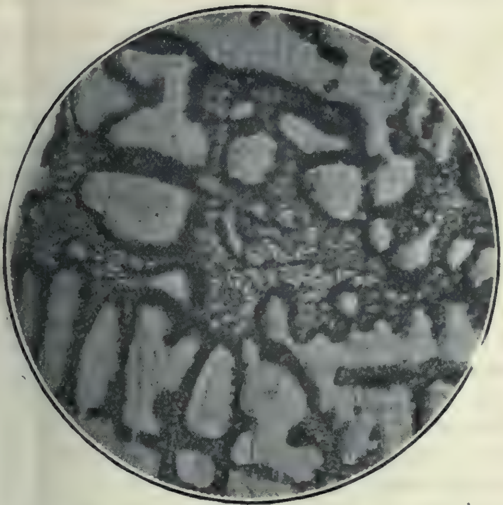


Fig. 9. 40 per cent.

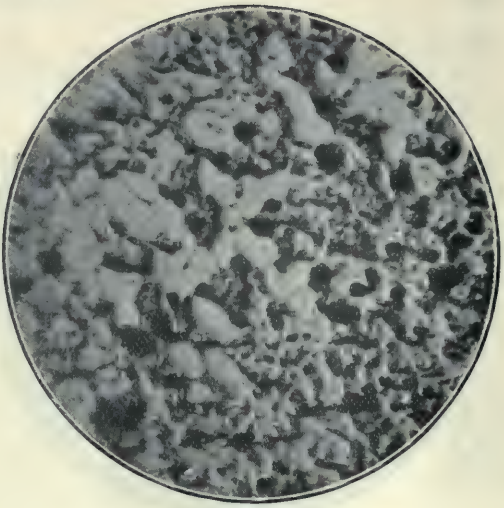


Fig. 12. 62 per cent.

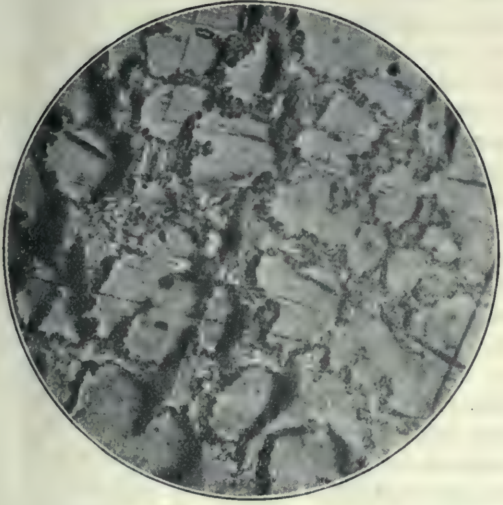


Fig. 10. 50 per cent.

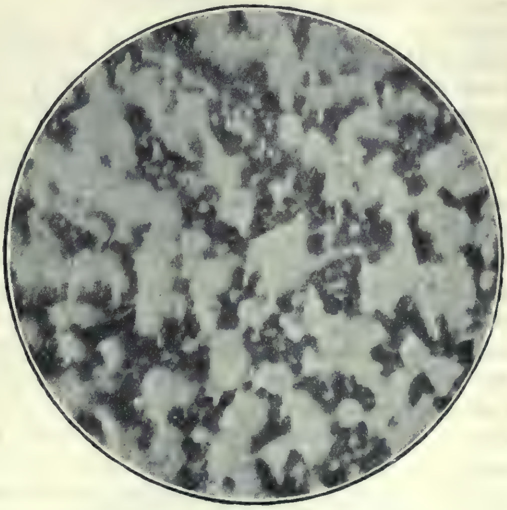


Fig. 13. 68·6 per cent.

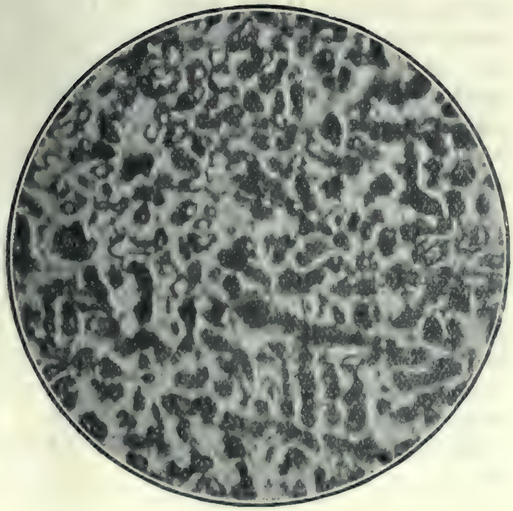


Fig. 11. 57 per cent.

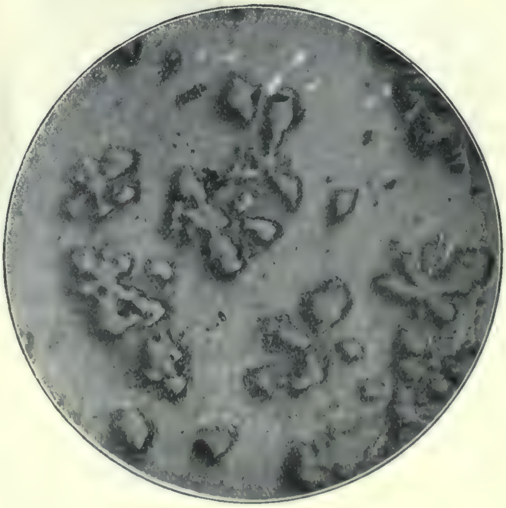


Fig. 14. 85 per cent.

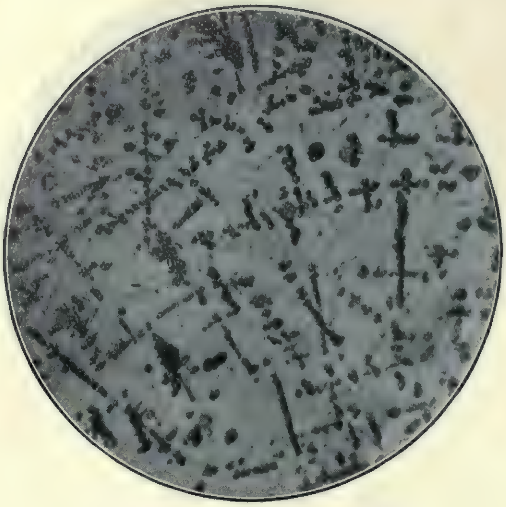


Fig. 15. 95 per cent. Bismuth.

with alloys containing 30 to 43 per cent. of copper it forms practically a horizontal line, with very little differences of temperature.

At a composition of 43 per cent. of copper there is a transition point, beyond which the curve rises gradually with increase of copper from a temperature of 858 deg. to 1,038 deg. C., which latter is the alloy containing 95 per cent. of copper. The point C is the transition point between solutions of copper in bismuth and bismuth in copper, and at this point the two solutions probably have the same freezing points, each being lowered by the addition of the other, thus forming a mixture or conglomerate of the two mixed crystals, which here exist in equilibrium. CD represents the freezing points of copper-bismuth solutions, and D the eutectic point of pure copper and copper-bismuth solution. DE represents the freezing-point curve of pure copper in contact with a solution of bismuth in copper.

In obtaining the freezing-point curve, it may be noted that the liquid portion is not in equilibrium with one of the component metals, except in the branches AB and DE. The solid component copper can dissolve the component bismuth until the concentration of the latter in the mixed crystal has attained a certain value. Addition of a further amount of bismuth may not alter the composition of the mixed crystal, but there will be found a second solid, consisting of a solution of copper in bismuth, and the three phases—mixed crystals with excess of copper, mixed crystals with excess of bismuth, and a liquid solution—may coexist. It is probable that in most of the copper-bismuth alloys, the mixed crystals, which are deposited from the liquid mass, lose their homogeneity at lower temperatures, even when rapidly cooled.

With regard to that branch of the curve which contains 30 to 40 per cent. of copper, it is possible that the compounds, Cu_3Bi_2 and Cu_2Bi, may be formed, but they can only exist in contact with solutions containing excess of bismuth. As the temperature falls the compounds are converted into another solid phase.

MICROSCOPIC STUDY OF THE ALLOYS.

The sections selected for examination were transverse, some of which were cooled very slowly while others were cooled quickly, immediately after solidification. They were polished on graded emery paper, and finally on a revolving bob, covered with chamois leather, and moistened with wet rouge. They were examined under the microscope both before and after etching. The etching liquid used was hydrochloric acid, to which a little nitric acid was added. In most cases the structure was revealed by simple polishing, and the patterns are fairly large.

The following is a detailed description of the various alloys. Fig. 2 is a photograph of the exterior of the alloys containing 1 to 5 per cent. of bismuth, showing the grains arranged in fern-like patterns. Fig. 3 shows the general exterior structure of the other alloys.

In alloys with 0·1 to 0·5 per cent. of bismuth, the structure is copper, with small percentages of bismuth, consisting of polygonal grains, the cell walls of which are of a light copper colour, and in the 0·4 to 0·5 per cent. alloys, a thin dark line, probably rich in bismuth, runs through the centre of these walls. Both the boundary lines and the bismuthide are harder than the interior of the grains, which is of a darker colour, and broken up into dark and light striations of an eutectic nature. If the interior of the grains is mainly copper, it very likely contains some bismuth, and this is probably attacked readily by the etching liquid, thus producing the irregular structure. Fig. 4 contains 0·4 per cent. of bismuth.

With 1 per cent. bismuth, the structure is similar to the alloy with 0·5 per cent., but on a larger scale.

The 2 per cent. preparation shows only two constituents, one copper red and the other of a dark colour, probably a solid solution of bismuth in copper. Each constituent is in fine portions, forming an eutectic mixture. This alloy is the one marked D in the freezing-point curve, and has a lower freezing point than either the 1 per cent. or the 3 to 10 per cent. alloys. Its structure is shown in fig. 5.

Fig. 6 is the 4 per cent. alloy and is very similar to fig. 5.

With 5 to 10 per cent. bismuth a complete change from the former alloys takes place—the interior of the crystal grains are very small and composed of an extremely fine eutectic structure. The light copper-coloured boundaries are very wide and contain segregated irregular patches of a light blue bismuthide, which is not uniform in structure, but made up of two parts, a little dark-coloured substance being mixed with the blue. The bismuthide constituent always appears in the boundaries, and in the 10 per cent. alloy forms an almost continuous network (fig. 7).

In 15 to 25 per cent. specimens, the 15 per cent. alloy has extremely well-defined crystal grains, the interior of which has a fine eutectic structure. In the 20 per cent. alloy there is less evidence of eutectic structure. In the 25 per cent. alloy (fig. 8) the green portion is about the same as in the 20 per cent. alloy, but the light-red crystal grains are well defined and homogeneous in structure.

With 30 to 40 per cent. bismuth, there is much more of the green eutectic constituent than in the former, the green body is also segregated in large patches. The copper-coloured grains in the 40 per cent. alloy become more readily oxidised, as seen in fig. 9.

When there is 45 to 55 per cent. of bismuth, the constituents appear to be the same as in the preceding, but in the quickly-cooled sample there is an additional constituent. Fig. 10, with 50 per cent. bismuth, shows the structure of these alloys.

Coming to alloys with 56 to 57 per cent. bismuth in the 56 per cent. alloy the light-green eutectic is replaced by a light-grey body, which occupies about half the field. Fig. 11 shows the 57 per cent. alloy. The whole surface is uniformly composed of grains of two solid solutions, the light grey and the light red. These are most probably dilute solutions of copper in bismuth and bismuth in copper, forming a eutectic mixture.

In the case of the alloys with 60 to 67 per cent. bismuth, the composition consists of the two solid solutions just mentioned. Fig. 12 is the alloy with 62 per cent. of bismuth, and corresponds to the formula Cu_2Bi.

With 68·64 per cent. bismuth (fig. 13) the proportions of the alloy correspond to the formula Cu_3Bi_2.

The 70 to 90 per cent. bismuth alloy has two main constituents, consisting of the red solid solution in a eutectic mixture. Fig. 14 contains 85 per cent. of bismuth.

In the 95 per cent. specimen (fig. 15) the structure is very characteristic of an alloy bordering on a eutectic mixture.

Where there is 97·2 per cent. bismuth, the alloy consists of a decidedly eutectic mixture, which covers the whole surface. This structure is shown in fig. 16.

The structure of the alloys containing 98 per cent. bismuth and upwards resembles pure bismuth, revealing the well-known tabular planes of cleavage, so characteristic of the metal bismuth. The colour is white, and the white crystals are associated with some of the above-mentioned eutectic.

The Canadian geological survey has issued a preliminary statement of the country's mineral production for 1904, which shows the value of the products to aggregate over £12,000,000.

The Fried. Krupp A.-G. Grusonwerk, who were the original makers of tube mills as first introduced into the gold-mining industry on the West Australian goldfields, have received an order for a number of these mills for the Eckstein group of mines on the Rand.

Mr. C. Crossley, writing from 9, Zenobia Mansions, London, W., says: It is surely time inventors organised themselves, and I am prepared to receive the names of all inventors who are willing to join a National Association to look after their general interests, and to resist legislation tending to deprive them of any of their rights.

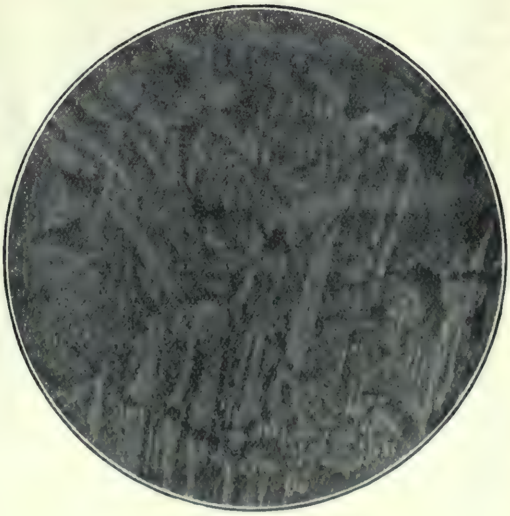
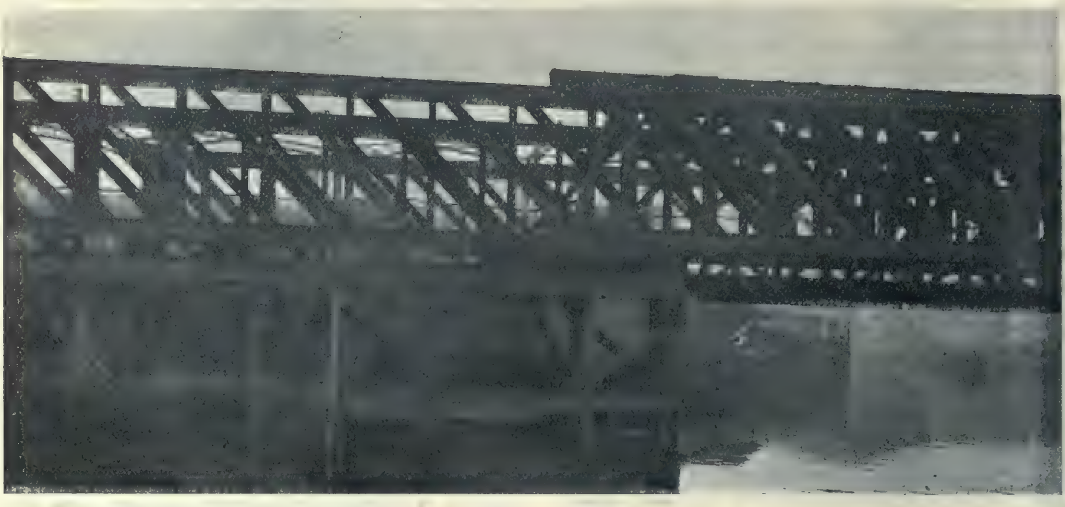


Fig. 16.—97·2 per cent. Bismuth.



VIEW FROM ISLAND LOOKING ACROSS RIVER LEA SHOWING PASSAGE OF GIRDERS CARRIED ON BOGEY TRUCKS.

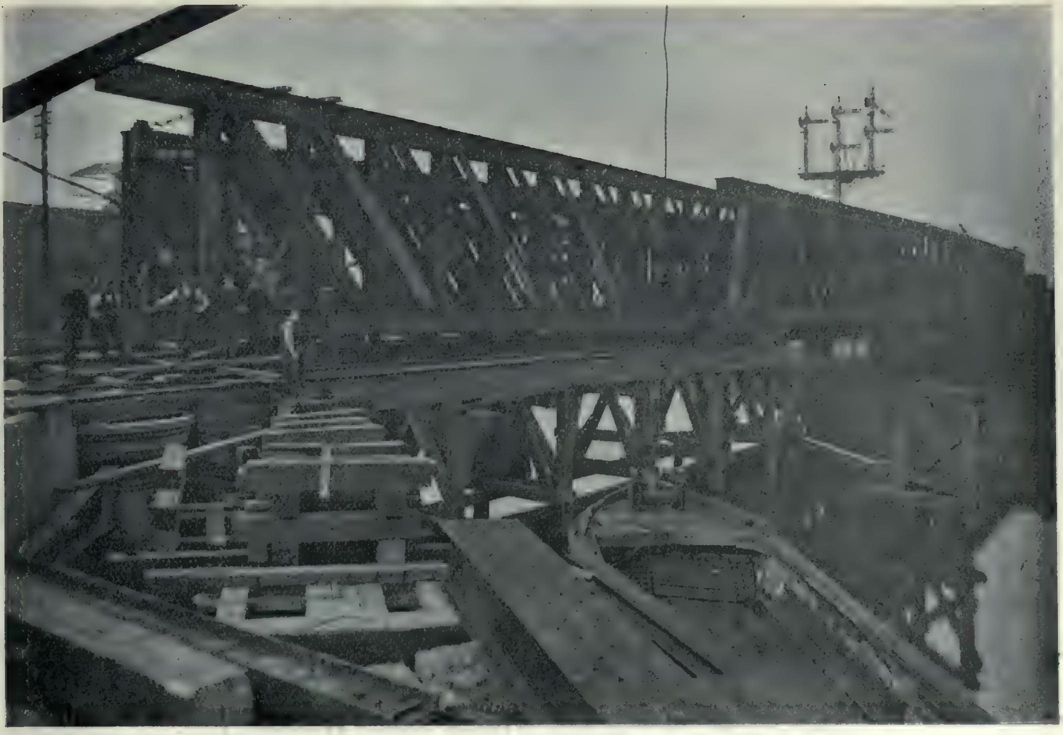
NEW L. T. & S. R. BRIDGE AT BROMLEY.

IN September of last year we called attention to the improvements which are being carried out on the London, Tilbury and Southend Railway, including the doubling of the rail capacity from Bromley to Barking and the provision of four pairs of rails between these points.

Not far from the new bridge over the main line of the North London Railway, which, as our readers will remember, was transferred to its abutments without causing a suspension of the traffic during the day, a lattice girder bridge, the largest of the series, is being erected over the River Lea and Bow Creek. This work is now in full swing and the progress made can be seen from the accompanying photos, which were specially taken for PAGE'S WEEKLY on Thursday last. The sectional drawing on page 738 will serve to indicate the general structure and dimensions employed.

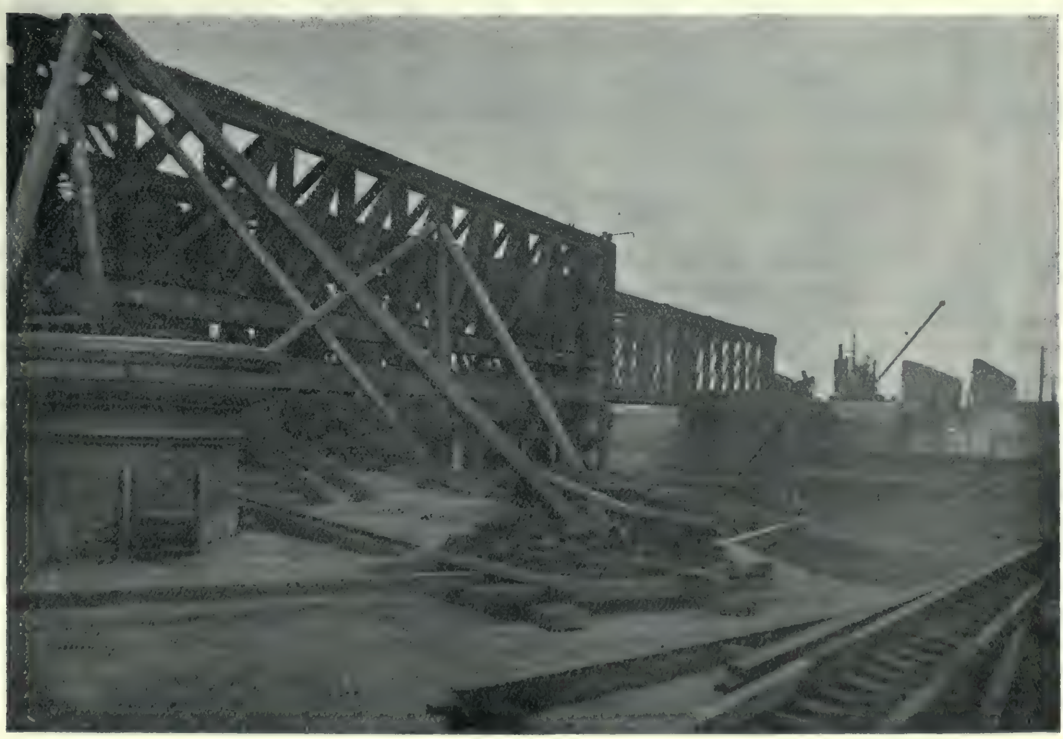
The bridge consists of two spans of 197 ft. 9 in. making a total length of nearly 400 ft. During construction a clear space of 50 ft. for each opening has to be allowed for navigation but the considerable skew has extended the openings to about 70 ft. The four main girders will be carried upon six substantial piers, the foundations of which rest upon the London clay, 23 ft. below the bed of the river and 50 ft. below rail level. The piers are of cast-iron filled with concrete, blue brick work in cement being used at the top. The two centre piers, which are situated on a small island in the middle of the river, have been tested with a load consisting of 760 tons of rails, while to the other piers a test of 380 tons has been applied.

The girders are now in process of being launched. Alongside the already existing bridge runs a temporary staging and the girders are brought over this from the country side of the bridge. The two girders for the river Lea span are now being dealt with, the north and south members being hauled across to their respective positions by steam winches. The process will be repeated for the Bow Creek span, but in this case of course the girders have only to be brought half way over. Temporary timber struts are fixed to the girders to counteract the reversed stresses of the tension members



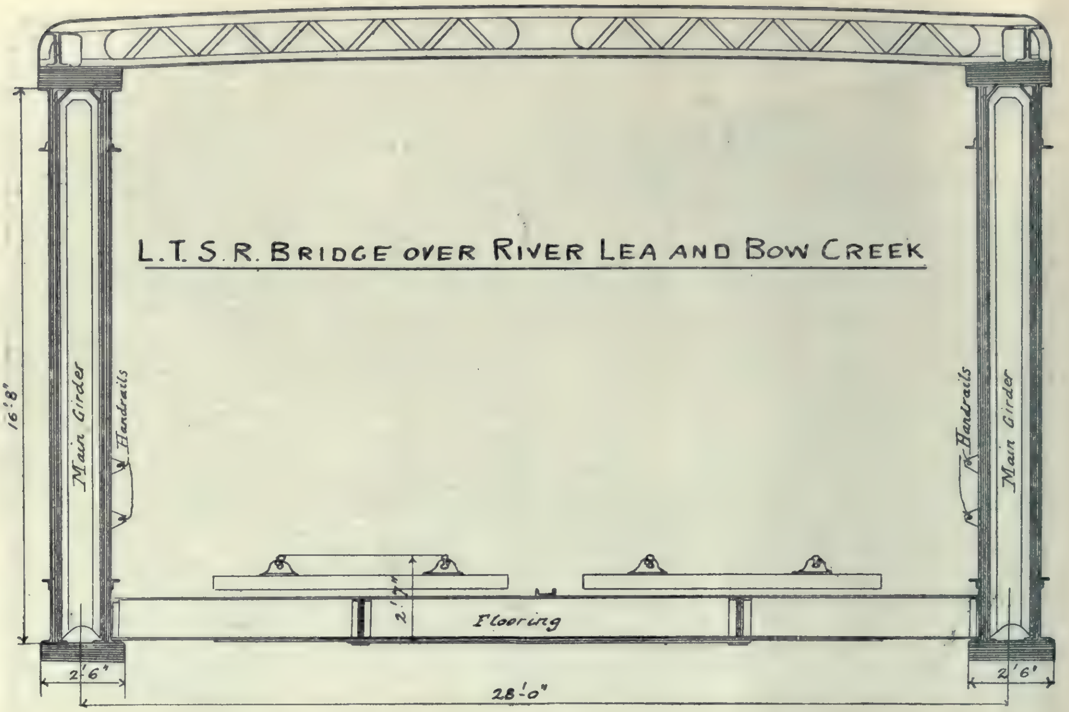
THE RIVER LEA SPAN.

The north girder has just been brought into position, and the temporary timber struts have been removed. Pier for south girder is seen on left.



VIEW OF BOW CREEK SIDE.

One of the piers (on island) is shown to left; existing railway bridge in rear. The two girders in distance are intended for the Bow Creek span.



CROSS SECTION OF THE NEW RAILWAY BRIDGE AT BROMLEY.

while the girders are being launched. The contractors for the foundations and piers of the bridge are Messrs. T. Docwra and Sons, of Balls Pond-road, N., and for the superstructure the Arrol Bridge and Roof Company, of Glasgow. Mr. James R. Robertson, M.Inst.C.E., the Company's chief engineer, is responsible for the bridge, which is being carried out under the supervision of Mr. S. Heaton-Ellis, A.M.Inst.C.E., resident engineer, who recently showed a representative of PAGE'S WEEKLY over the works.

A LIGHTING INVENTION.

We have received a copy of the British Fire Prevention Committee's report on the Petrolite Lamp—this being the first test of a lamp for burning mineral oil undertaken by the committee. The tests were confined to the lamp after it had been filled and lighted, and in their summary the committee report that it stood the several tests made. On no occasion did the lamp fail to go out when upset, and no spirit escaped. During these tests the lighted lamps were repeatedly overturned, and also rolled among shavings and other inflammable material. The new invention is the result of experiment and research by Dr. Hugh Marshall, D.Sc., F.R.S., lecturer in chemistry at the University of Edinburgh, aided by Mr. Alfred Jaray, A.M.I.E.E. It is claimed that the cost of burning a Petrolite lamp giving 50 candle-power is less than one quarter that of ordinary paraffin lamps. In the Petrolite lamp the air is automatically and continuously carburetted by being made to pass in a downward direction through a receptacle charged with absorbent non-combustible material, saturated with light hydro-carbon (petroleum spirit), such receptacle being immediately below the burner, and the carburetted air being raised through a tube direct to the burner from the absorbent material by the heat of combustion in the chimney. The regulation of the lamp is carried out by the simple arrangement of turning one lever only, which simultaneously controls the air inlet to the carburetter, the carburetted air exits from the carburetter to the burner tube, and the air supply to the latter. It is being introduced by Petrolite, Ltd., of York Road, Lambeth, S.E.

The Mineral Resources of India.

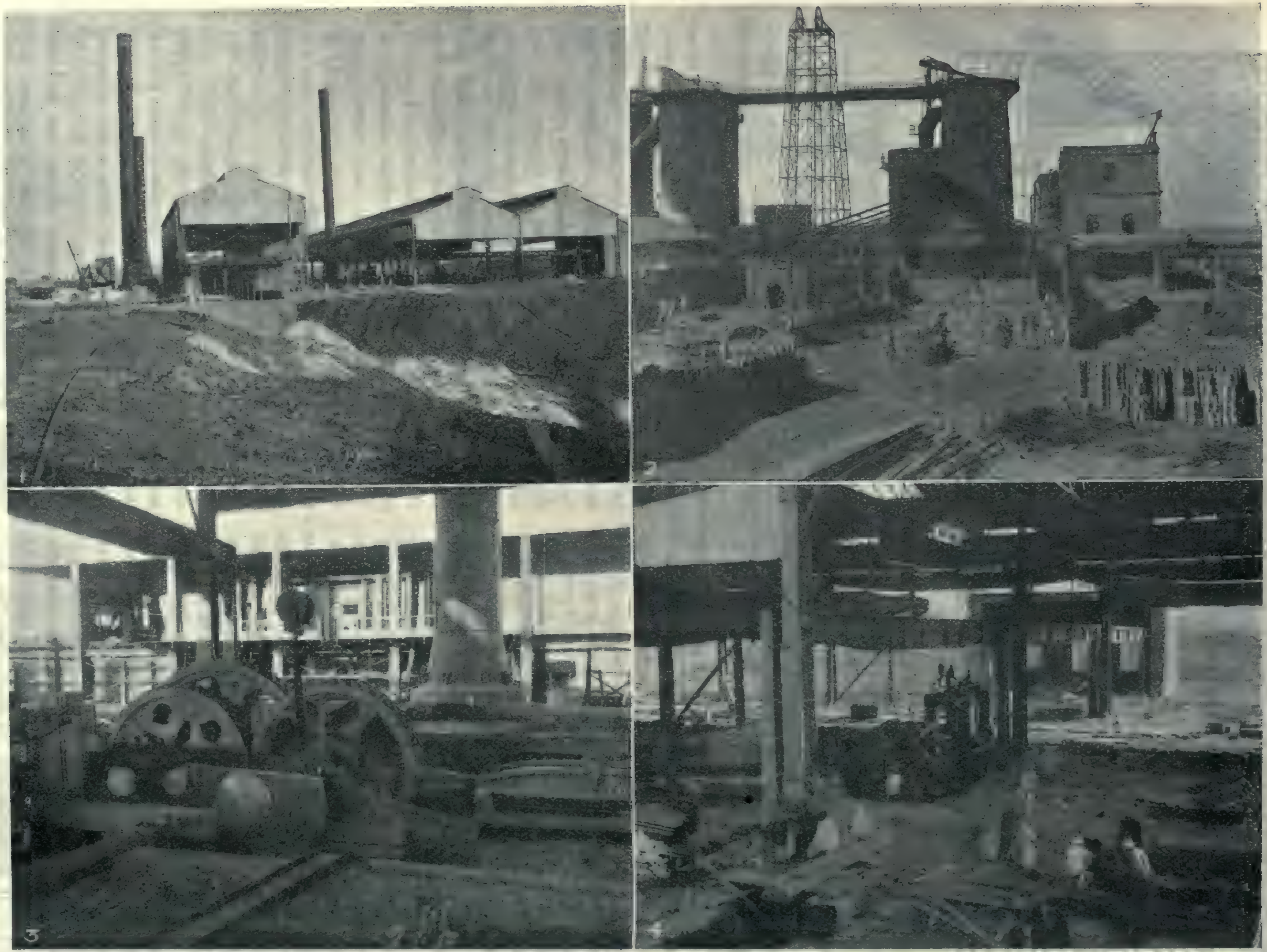
IRON AND STEEL PROSPECTS.

THE iron and steel industry in India is about to enter upon a new phase. Hitherto the works at Barakar of the Bengal Iron and Steel Company have constituted the only successful attempt to deal with iron in India on original lines. That there is room in the country for a large iron manufacturing industry is revealed by the figures dealing with the import trade. During the six years 1898-1903 the average annual value of iron and steel imported was £3,078,065, and this takes no account of the imports of machinery. Moreover, these imports have been rising year by year, being valued in 1903 at £4,136,184. Whether the proposal to work the rich iron and aluminium deposits which exist in the Central Provinces is a practical one appears to be a little doubtful. The latest official intelligence is to the effect that the prospective operations which have been carried on in the Central Provinces have resulted in one area unsuccessfully, while in another the result is undetermined at the present time. Unofficial reports state that American mining experts, brought to India by the late Mr. Tata, have established the existence in the Rhaipur district of the Central Provinces of immense quantities of an extermely rich iron ore. The clue to this discovery was first given it is said by the Government geological surveyors, and was promptly taken up and acted upon by practical men. A company, with capital of over a million and a quarter sterling, is to be formed at once for the exploitation of this field, and, if it succeeds, it should be but the pioneer of other companies which cannot fail to be of extreme importance in the development of industries which have hitherto been dealt with in no systematic way.

At the outset it was considered probable that the Indian Government would be asked to guarantee capital, but it is satisfactory to learn that the new developments are to be financed and controlled by private enterprise.

MINERAL STATISTICS.

It will be opportune to make some reference to the review of the mineral resources of India, covering the years 1898-1903 which has just been issued by the Indian Geological Survey Department. This publication is the first of a series of reports which, in future will be issued quinquenially. The table reproduced on page 741 shows the principal minerals produced during the six years under review. It will be noted that there has been a steady uninterrupted progress in production, and an increase of 44·37 per cent. is recorded in the total figures, a gain to which practically every mineral has contributed. An analysis of the table reveals two conspicuous features; first, the remarkable progress shown in developing the few minerals which are consumed like coal, gold, petroleum, etc., by what may be termed direct processes, or which are raised for simple export, such as manganese ore, graphite, mica and tin. Moreover, no one who studies the figures can fail to note the extraordinary neglect of the metalliferous ores and minerals necessary to the more complicated chemical and metallurgical industries. This is in great measure explained by the fact that in the case of metalliferous ores the by-product is often a main source of profit, and unless the by-product can be utilised it will not pay to treat the ores for the sake of the metal alone. Take the case, for instance, of the copper sulphide ores; it is common knowledge that many of the great copper mines of the world could not work at a profit but for the demand for sulphur in sulphuric acid manufacture, and naturally there can be no demand for sulphuric acid in a country where the chemical industries involving its use do not exist. India has therefore had to be content to pay the tax of imports until industries arise demanding a sufficient number of chemical products to complete the economic cycle.



BENGAL IRON AND STEEL COMPANY'S WORKS AT BARAKAR.

(1) Steel works from slag tip. (2) View of furnaces. (3) Cogging plant. (4) View of works looking down from steel furnaces. The works give employment to over 3,000 natives, and a European staff of about 60.

MANGANESE ORE MINING.

One striking fact is illustrated in the table printed below and in the diagram shown on page 742; that is the rapid rise of manganese ore mining. Twelve years ago the industry was practically unknown in India, but the Peninsula is now turning out a larger quantity of high-grade manganese ores than any other country except Russia. Although manganese ore mining was only recently started in the Central Provinces, the richness and purity of the ore bodies opened up has caused a remarkable expansion in the industry, and the recent discovery of deposits in the Bombay Presidency near the coast will probably give a fresh impetus to the export trade, a process which cannot however, be regarded with unmixed satisfaction in view of the possibilities for development within India itself.

A good deal turns upon whether India can create that demand for sulphuric acid which would complete the economic cycle to which reference has been made. There seems to be no doubt that sulphuric acid could be produced in India more cheaply that it can be imported, and this should, in its turn, lead to the development of fresh industries depending for their profitable working on cheap sulphuric acid. Once a home market is created it would make possible the profitable production of copper, for which there is great demand in India.

Turning to the iron industry the latest figures available show that there is a general decline in the Indian charcoal iron trade within range of the railways which distribute the cheap imported material, but that in more remote parts of the Peninsula the old industry persists, and, indeed, in certain districts of the Central Provinces has even improved. In the Lamhalpur district there are over 200 small direct furnaces at work.

NEW STEEL WORKS AT BARAKAR.

The most important development at this juncture is the initiation of the manufacture of rolled steel on a commercial scale from indigenous raw material at Barakar: an event not only of importance in itself, but constituting an essential development by reason of the fact that it will create a local market for the manganese ore of the Central Provinces, of Bombay, and of the Madras coast, thus enabling even inferior ores to to be utilised, and giving to producers the whole market value of the commodity whereof a good deal is now lost owing to the necessity for exporting the ores. The works at Barakar, now owned by the Bengal Iron and Steel Company, were, it will be remembered, taken over from the Government in 1889, and although the company has enjoyed a somewhat fluctuating prosperity, the undertaking on the whole has been fairly successful. About eighteen months ago it was decided to erect works for the manufacture of steel, and these works, which are now practically finished and have been designed for an output of 25,000 tons, are, of course, the first of their kind in India. The works were designed by Mr. J. Angus, M.Inst.C.E., the company's consulting engineer. Judging from samples of steel which have been produced, and to which the usual tests have been applied, there appears to be no doubt as to the ability of the works to turn out steel of a quality equal to anything of the kind produced in Europe or America. The demand in Bengal alone for rolled steel in the form of rails, joists, tees, angles, etc., is very large. It is stated that this trade, excepting rails, has hitherto been almost entirely in the hands of the Belgians, and Barakar steel will consequently for some time to come have to compete with the products of Belgian and German rolling mills. This is only a beginning in the development of the iron

TABLE I.—*Total Value of Minerals for which Returns of Production are available for the years* 1898 *to* 1903.

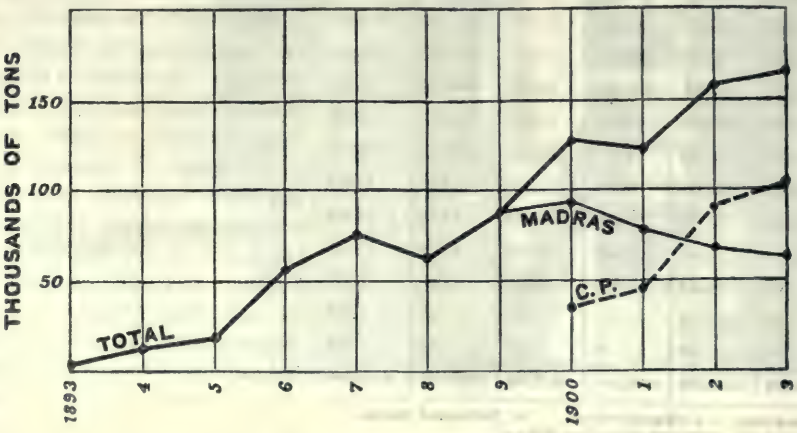
MINERALS.	1898.	1899.	1900.	1901.	1902.	1903	Average.
	£	£	£	£	£	£	£
Gold	1,608,504	1,724,906	1,891,767	1,930,411	1,970,230	2,302,493	1,904,719
Coal (*a*)	957,162	1,063,820	1,343,081	1,323,372	1,366,909	1,299,716	1,225,677
Salt (*b*)	358,933	312,682	325,970	409,019	344,683	336,147	347,897
Saltpetre (*c*) ..	265,896	232,896	256,210	294,249	237,880	288,487	262,603
Petroleum (*a*) ..	67,897	125,684	148,755	200,342	217,816	354,365	185,810
Rubies	57,950	90,848	97,326	104,476	86,895	98,575	89,345
Mica (*c*)	53,890	73,372	109,554	70,034	87,594	86,277	80,120
Manganese-ore ..	27,426	39,529	77,304	79,119	120,538	132,741	79,448
Jadestone (*c*) ..	41,780	42,120	58,955	46,877	31,713	47,676	44,770
Iron-ore (*e*) ..	12,408	12,836	11,171	13,598	16,533	14,963	13,584
Graphite (*d*) ..	110	7,620	9,145	13,635	24,410	16,970	11,981
Tin	2,553	7,900	8,534	7 773	5,310	9,153	6,875
Magnesite (*d*) ..	..	56	150	..	2,360	550	519
Amber	1,061	151	103	11	432	414	362
TOTAL ..	3,455,565	3,734,420	4,338,025	4,492,416	4,513,283	4,988,527	4,253,706

(*a*) Spot prices. | (*b*) Prices without duty. | (*c*) Export values. | (*d*) Estimated values.
(*e*) Estimated values for provinces other than Bengal.

resources of India. At present the Barakar works will only produce some 500 tons of steel per week, but ultimately it is intended to extend the steel works, and it is hoped that in the future India will be in a position to supply the whole of its own requirements for rails, as well as steel for a variety of other purposes. The output can easily be made to keep pace with demand. and produced, as it is, mainly by cheap native labour, Indian steel ought to conquer the market, which is at present almost monopolised by Germany and Belgium.

The only place in India where the rolling of steel has hitherto been attempted is at Jamalpore, where the East Indian Railway Company have also been making castings for the company's use. The new company to which reference has been made is said to contemplate much more than the mere working of iron ores at Rhaipur, an operation which will be facilitated by the fact that direct railway communication exists with the Bengal coal mines as well as those of Warora in the Central Provinces, and Umaria in Rewah. Simultaneously with the new demand for coke for the blast furnaces which are to be set up, arrangements are proposed to be made for its preparation at the coal fields by the most modern methods. It is understood also that the artillery re armament of the Indian army is to be carried out as far as possible in India itself, and this will create no inconsiderable demand for steel for ammunition. All these things point to the fact that we are on the eve of important developments in connection with the iron and steel industry in India.

Quite apart from the results of the geological survey quoted, there is known to exist an abundance of high-class ore in the Peninsula. As far north as the Himalaya mountains and in the Punjab and the Madras Presidency magnetic oxide of iron has been located.



PRODUCTION OF INDIAN MANGANESE ORE SINCE 1893.

Shipbuilding Notes.

On Saturday, the 25th ult., there was launched from the shipyard of Messrs. Cochrane and Sons, Selby, a handsomely-modelled steel screw trawler, this being the sixth vessel built to the order of the Great Central Co-operative Engineering and Ship Repairing Company, Ltd., of Grimsby.

The s.s. *Benue*, which has been built by Swan, Hunter, and Wigham Richardson, Ltd., Wallsend-on-Tyne, for Messrs. Elder Dempster and Company, for their West African Trade from Liverpool, was taken out to sea on the 27th ult. for her trial trip. The vessel carries a deadweight cargo of about 4,780 tons on a draft of 21 ft. 1¼ in. The machinery has been constructed by the Wallsend Slipway and Engineering Company, Ltd., and consists of a set of triple expansion engines, having cylinders 25 in., 41 in., and 68 in. with a 48-in. stroke, steam being supplied by three large single-ended boilers, working at 180 lb. pressure, fitted with Howden's forced draught. On the trial trip a speed of 12¾ knots was attained on the measured mile. Over a trial of 6 hours' duration the average speed was over 12 knots.

HARTLEPOOL.

The new steel screw steamer *Harmony*, by Messrss. Furness, Withy and Co., Ltd., of Hartlepool, is a sister vessel to the s.s. *Harmonic*. The vessel is built on the deep frame principle with a measurement capacity of 264,126 cubic feet. She is of the single-deck type with poop, bridge, and forecastle and takes Lloyd's highest class. The hatches are of large size and specially arranged for the carriage of large Pensacola logs, bulky cases, etc. Wood shifting boards are arranged throughout the holds, cellular double bottom is fitted all fore and aft for water ballast as well as the after peak. Ten winches of powerful make will be made and fitted by Furness, Withy and Co., Ltd. Triple-expansion engines will be supplied and fitted by Messrs. Richardsons, Westgarth and Co., Ltd., Hartlepool, with cylinders 23-in., 40 in., 65 in., and 42 in. stroke; two single-ended boilers, 15 ft. 6 in. by 10 ft. 6 in. will be supplied to German Law requirements.

The Heat, Light, and Power Requirements of London.

A PROPOSITION.

By B. H. Thwaite.

It will probably be agreed that the present time provides the psychological moment in which to formulate a scheme of unity of the most efficient and latest developments of the different branches of applied science to secure the full advantages possessed by the intense concentration of the field of demand represented by the London Metropolis for heat, for dynamic power, and artificial light producing agencies.

Existing agencies are neither economical nor efficient, and the aggregate effect of inefficiency is responsible for a condition of atmospheric impurity more or less sustained through the year, but which in winter culminates in days of black filthy fog representing financial losses of very great magnitude.

Berlin, Paris, and New York are free from this atmospheric pollution, which with our laissez-faire policy and condition of dangerous apathy is permitted to go on from year to year without a single serious attempt being made to boldly grapple with the evil.

Surely British engineers will not have once more to be indebted to American or German engineers and enterprise, to remove what is neither more nor less than a disgrace to British science. The evil is the visible symbol of the inefficiency in our existing methods of utilising the carbonaceous resources which constitute one of our principal and most valuable national assets.

To-day and every day in the year the grates of London are pouring into the air environment of the Metropolis the major part of the volatile hydrocarbons, the sulphur as well as the water vapour resulting from the oxidation of the hydrogen of the hydrocarbonaceous coal used on London grates. Were these hydrocarbons and nitrogenous matters recovered just as they are in all modern by-product coke oven and gas lighting installations, these agents of London's atmospheric pollution would constitute a financially valuable asset that should cover a considerable part of the cost of the coal. There would remain besides, a high-class coke, ignitable with modern wood fire lighters, and this, if broken, would provide London householders with an ideally clean fixed-carbon-fuel actually incapable of producing coal smoke. The Englishman's cherished open fire would thus be preserved without the luxury involving, as it does now, the production of London's black disgrace.

How absurd, is it not, to expend money in the elaborate carving in the façades of our new city buildings, when actually by the time the level of the cornice is reached in the construction of any new and often noble and artistic examples of architecture, the basement part of the façade is more or less disfigured by the element of smoke.

If this dark smoke evil of London were radically removed (and this is quite practicable as will be demonstrated, and without involving the suppression of open grates), the general application of the sand blast as is being done to the Strand façade of the Hôtel Cecil, would in a few years transform London into a city of palaces and architectural delights.

Even the preservation of Sir Christopher Wren's architectural masterpiece is alone worth some effort, and but for the evils of inefficient methods of fuel combustion our buildings would be as free from disfigurement as are the towers and steeples of the sixteenth century churches above the level of 40 to 50 ft. This, apparently, is the vertical limit of smoke deposition, which sets up an erroding effect, due to the presence of sulphur that soon destroys the sculptured beauty of capital and tracery. The mere fancy that Pugin, Barry and Wren's work in the legislative buildings and in St. Paul's may be removed from its dirty smoky covering, and restored to the colour of the original stone and marble of which they are built, makes one long for the carrying out of a proposition that will enable such a transformation to be accomplished.

Of course, the origin of the water nucleus of the fog is due first to the oxidation of the hydrogen constituent of the hydrocarbons (from this source thousands of tons of water vapour are poured into the air), and secondly, to the escape into the air, unburnt, of the most volatile proportions of the hydrocarbons of the coal, so that even the use of high illuminating retort gas, composed of hydrocarbons, is not altogether an ideal fuel, and this fact constitutes a further argument in favour of the author's proposition made thirteen years ago, that the photometric value of London town gas should be reduced to ten candle-power to do full justice to the economic possibilities of the Welsbach system of gas lighting, and at the same time reduce the smoke evil.

The author in the National Review of November, 1892, formulated a scheme of distributing low candle-power gas generated in the coal fields to the Metropolitan Supply Companies' stations. In November, 1894, the author formulated a scheme in the Nineteenth Century for generating electric energy at the coal fields by means of internal combustion engines. This latter scheme included the recovery of the valuable nitrogenous and hydrocarbonaceous constituents of the coals, and the use of internal combustion engines as the power producing agents. Since the date of this last proposal, practical science has proved that by the adoption of high capacity steel freight cars, it will be possible to very greatly reduce the cost of the rail transit of coal to London, so that the economy to be derived by transmission of fuel energy in either high-pressure electrical or gaseous form is endangered. Further, the perfection of modern by-product coke ovens leaves little further margin for thermal efficiency improvement. These two important facts constitute the economic basis for the proposition to be formulated, that would in its practical consummate effect, provide London consumers of power, light, and heat with exceptional advantages, and would remove for all time the root cause of the pollution of London's atmosphere.*

Dr. C. W. Siemens proposed over a quarter of a century ago that if coke and cheap gas were employed in London grates the smoke plague would be killed, but with modern fire lighters there would be no absolute necessity to employ gas along with the coke, although for all cooking and other heating operations the gaseous agent delivered with comparatively high calorific value, but low photometric power, at a considerable reduction in cost below present prices, would become far more popular even than it is to-day. Now the proposition includes the production of the following agents, and in bulk:—

(*a*) A high quality of silvery white and uniformly broken coke, delivered at a low price in motor wagons to London householders.

(*b*) A bulk-supply of 9 to 10 candle-power gas (the product from the coking operations), to the Metropolitan Gas Companies' stations.

(*c*) A bulk supply of electric energy, generated in internal combustion engines from gas made from the small coke and dust residue of the coking operations, and part of the gas from the coking operations available for all the London Electric Supply Companies' distributing stations. The thermal efficiency of the internal combustion system of power generation would be about twice that of existing steam power stations.

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* The author discussed the economies of a similar proposition applied in the German capital some years ago with Dr. von Bauer.

The stations for the production of the bulk supply of the three agents would be so located as to best secure the use of the advantages of the Amercian freight transport system* on our railways, and one plant would also be installed to receive the sea-borne coals direct from the colliers. All the modern methods of mechanical transportation and elevation being used to reduce manual labour as far as practicable.

The stations would be equipped with the most perfect type of by-product coke ovens, so that the utmost possible extraction of the thermal and chemical values of the coals would be secured.

The author, from his examination of the coke ovens (designed by Dr. Schneiwind and Dr. von Bauer), in the United States and Germany, is quite satisfied that the proposition now briefly formulated, will secure economies that would mean directly and indirectly several millions a year saved to Londoners, and this without involving the complete suppression of the open fire we love so well. The householders of New York and Berlin and Paris employ a fixed or non-hydrogenous carbon fuel, and London's citizens, once an abundant supply of high quality broken and cheap coke is available, should be legislatively compelled to do the same.

The proposal suggested would benefit :—

1. London householders and hotel proprietors.

2. Existing electric supply companies and power consumers generally.

3. Existing gas supply companies who should have power to distribute gas of low calorific value, but of standardised calorific value, as it would secure for them unity of the greatest triumphs of modern science in its relation to lighting, heating, and power production, for the service of London and London's millions of inhabitants, and would in its ultimate effect make London the pride of the empire.

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* The reduction of dead load ratio to live load, by the use of high capacity wagons, was demonstrated by the author in his lecture in 1898, before the London Chamber of Commerce on "British and Foreign Railway Freight Rates."

COOLGARDIE WATER SUPPLY.

AT the ordinary meeting of the Institution of Civil Engineers, on Tuesday, March 28th, 1905, Sir Guilford L. Molesworth, K.C.I.E., President, in the chair, the paper read was "Coolgardie Water Supply," by C. S. R. Palmer, M.Inst.C.E. The following is an abstract :—

After inquiring into alternatives, it was recommended that the work should consist of a storage-reservoir in the Darling ranges (capacity, 4,600,000,000 gallons, enough for two years' supply and loss), a 30 in. pipe to carry thence 5,000,000 gallons daily, a series of pumping stations along the pipe line, and service reservoirs at various centres; the estimated cost of these works being £2,500,000.

The total lift was calculated to be 2,655 ft.; but to provide for identical pumping sets, 2,700 ft., in four lifts of 450 ft. and four of 225 ft. was arranged for. Results of tests of actual friction-head made on laying the main are given; also the working and reserve power, the cost of the machinery, the tests provided in the contract, and the results obtained. These reservoirs are of concrete, and consist of six of 1,000,000 gallons each for pump suction, two of 500,000 gallons for regulation of flow in the main, and one of 1,000,000, one of 2,000,000, and one of 12,000,000 gallons for service purposes. Drawings are given typical of all but the last, which is of separate design. Its concrete lining is thin, unbacked, and built in sections, with expansion joints filled with bitumen between sections. A grillage of barbed wire in each section keeps it intact, and the joints are easily caulked when necessary. Normal sand being too expensive, a fine loamy sand was used for the concrete of the large service reservoir, with good results. The original scheme did not provide for reticulation of townships, but this was eventually carried out at Coolgardie, Kalgoorlie, Boulder, and the Kalgoorlie mining belt. A telephone line, 380 miles long, connects headquarters, the pumping stations, and the service and regulating reservoirs with each other.

A NEW PROJECTILE LATHE.

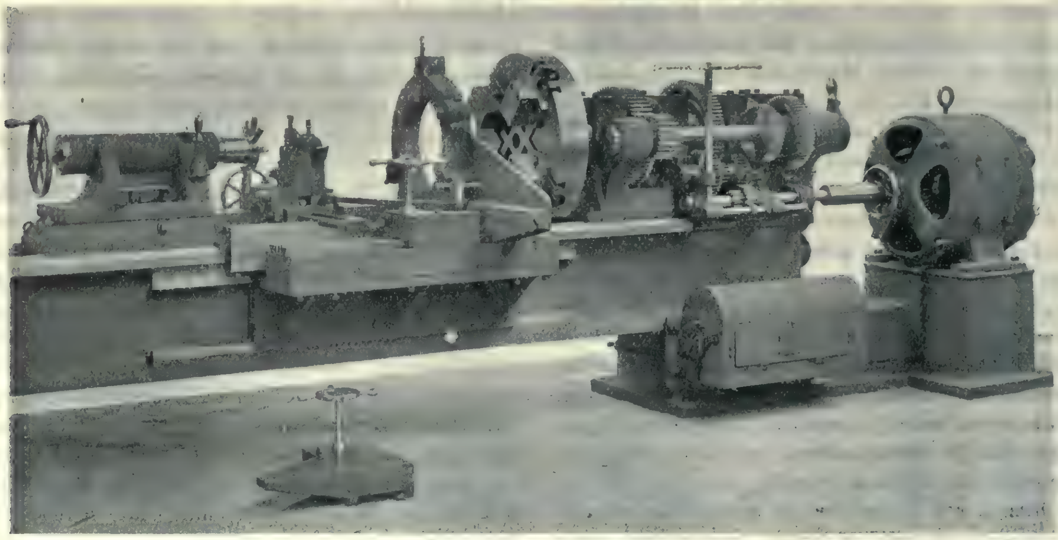
BY THE LODGE AND SHIPLEY MACHINE TOOL COMPANY.

THE Lodge and Shipley Machine Tool Company, of Cincinnati, Ohio, have just built a new lathe for turning projectiles. The machine, which is illustrated herewith, is driven by a 15-h.p. Ridgway motor, mounted on an extended sub-base at the head end of the lathe. The motor has 20 speeds, ranging from 350 to 750 revolutions per minute. The controller for the motor is mounted on the rear, and is operated from the carriage or the headstock by the vertical hand wheels which engage a splined bar connected to the controller at the head end by a chain.

The back gearing in the head has a ratio of 1·62 to 1 and 2·62 to 1, and the speed ratio of the motor shaft to the live spindle is 7·48 to 1 and 15·1 to 1. All of the main driving gears in the head have cast-iron centres and steel rims of extra width. Extra-heavy spindle bearings are used, the front one being 7⅞ in. in diameter by 8¾ in. long, and the back one 7½ in. in diameter by 5⅝ in. long. The spindle is of crucible steel 0·55 carbon and has a 2⅜-in. hole through its centre.

At the slowest speed of the motor the lathe has a cutting speed for roughing the body of the shell of 30 ft. per minute, and of 60 ft. per minute for finishing. As will be seen from the accompanying views, there is a spirally milled cylinder on the speed control shaft immediately under the apron. This provides an automatic, mechanical and full electric speed variation for varying diameters, so that the cutting speed may be continuous from 2-in. diameter up to the largest diameter of the projectile.

The tool post is of steel, and the steady rest is of a special design, which may be quickly applied and removed. Another noteworthy feature is the radial attachment by which the tool carriage is moved perpendicularly to the work to give any one of several curves to the projectile nose. The chuck was made by the lathe builder and is of a massive and substantial design, particularly adapting it to the work for which it is intended. The diameter gauges are mounted on the nose of the tailstock and in practice are found to afford considerable economy in time.



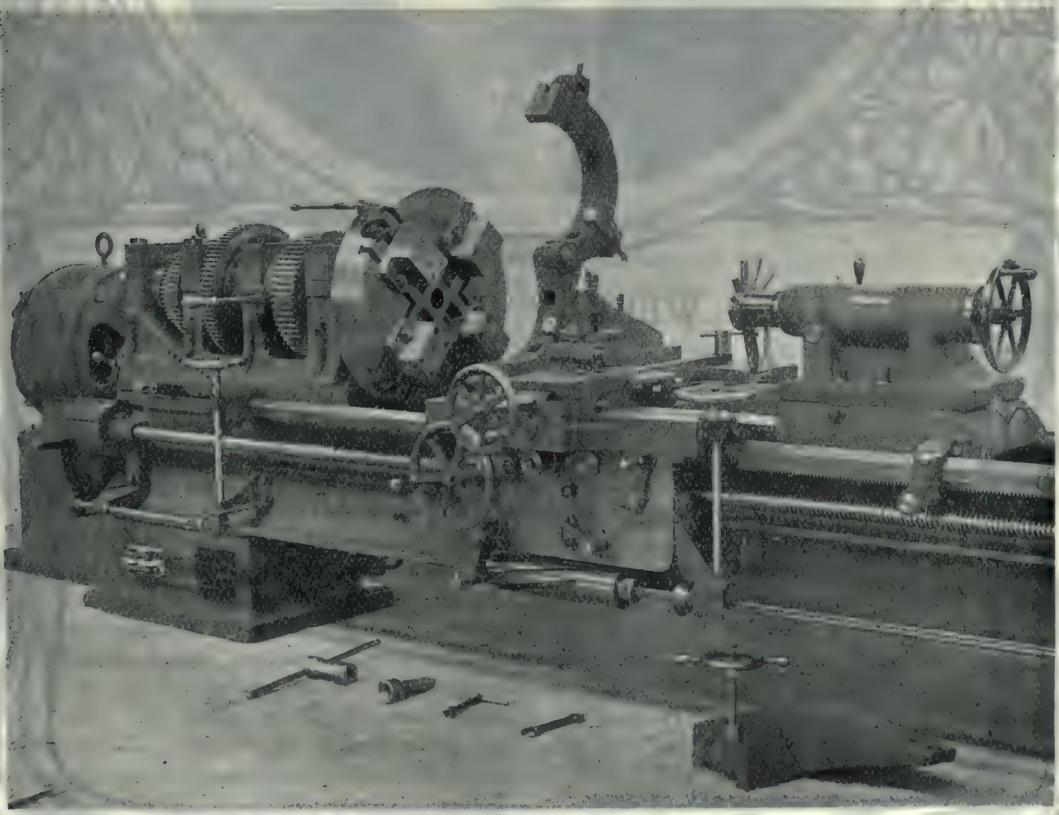
REAR VIEW OF 27 IN. × 14 IN. PROJECTILE TURNING LATHE, EQUIPPED WITH NEW PATENT HEAD AND MOTOR DRIVEN

INSTITUTION OF NAVAL ARCHITECTS.

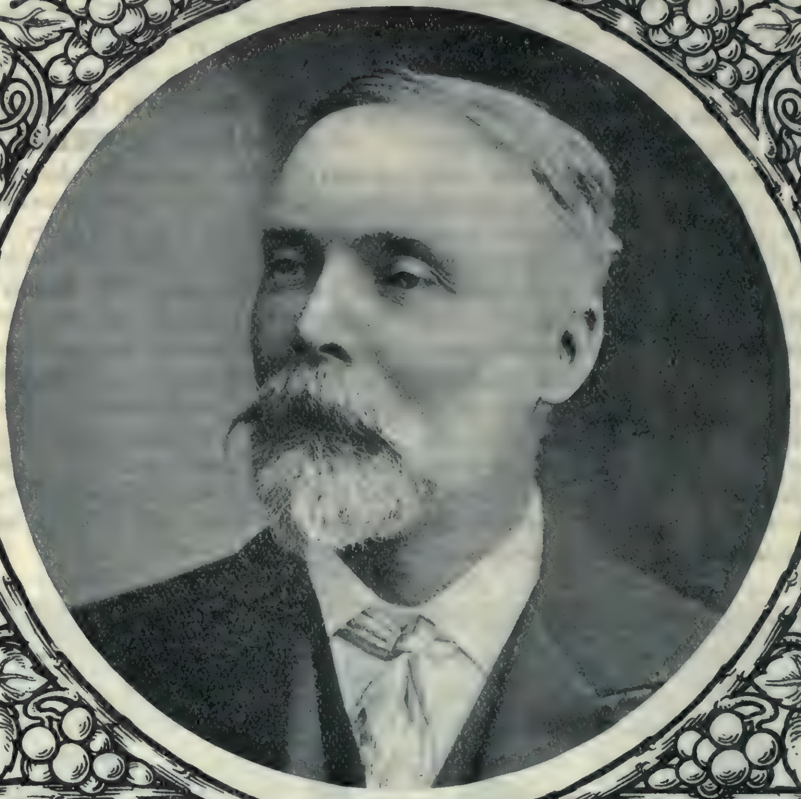
THE meetings of the Institution of Naval Architects for the session 1905 will be held in the hall of the Society of Arts, John Street, Adelphi, on Wednesday, Thursday, and Friday, April 12th, 13th, and 14th. Lord Glasgow, president of the institution, who will occupy the chair, will deliver his address on Wednesday, April 12th, after the annual report has been presented, the president, officers and council elected, and other business transacted. Mr. W. E. Smith, C.B., Colonel N. Soliani, and Mr. Herbert Rowell will submit papers for discussion on the first day. On the following day, Thursday, April 13th, Professor J. H. Biles will read a paper on "The Strength of Ships with Special Reference to Experiments and Calculations made upon his Majesty's Ship *Wolf*," and other papers will be submitted by Mr. F. H. Alexander, and Mr. J. Bruhn, Mr. R. E. Froude, Mr. C. E. Stromeyer, Mr. A. W. Johns, and Herr S. Popper. Among the papers to be read on the third and last day of the session is one on "The Admiralty Course of Study for the Training of Naval Architects," by Mr. E. L. Attwood, and another on "Submarine Signalling by Means of Sound," by Mr. J. B. Millet, of Boston, U.S.A. Papers will also be submitted by Mr. A. E. Seaton, Mr. J. H. Heck, and Mr. A. Mallock. The annual dinner will be held on Wednesday, April 12th, in the Grand Hall, Hotel Cecil, at 7.15 p.m.

A STEEL FRAME WAREHOUSE IN EIGHT WEEKS.

A CONTRACT has just been placed with Messrs. Graham, Morton and Co., Ltd., for the construction and erection of a large warehouse at East Quay, South Dock, for the Alexandra (Newport and South Wales) Docks and Railway Company. The building is to be 200 ft. long and of 70 ft. span, and the whole of the ironwork will be in position eight weeks from the date of the order. This, of course, consists of roof principals, purlins, riveted compound steel girders, rolled steel girders, the usual gutterings, etc., and a specified number of casements constructed to open in the centre. All steel used in the construction is to be of the best quality mild steel. The principals are to be spaced 12 ft. 6 in. apart.



SIDE VIEW OF PROJECTILE LATHE.



OUR WEEKLY BIOGRAPHY.

MR. JAMES CHARLES INGLIS, General Manager Great Western Railway.

BORN in Aberdeen in 1851, Mr. James Charles Inglis was educated at the local grammar school, and subsequently studied for three years at the university, where he secured prizes in natural science and mathematics. During the intervals between the sessions, by working in the shops of a village mill-wright, he fairly mastered the elements of mill-wrighting, so that on leaving the university in 1870 he at once entered the works of Messrs. Norman, Copeland and Co., engineers and millwrights, Glasgow. The industry carried on by this firm was the construction of heavy industrial plant, largely for steel works, and here Mr. Inglis worked for two years.

On the advice of the late Alexander Kirk, M.Inst.C.E., of Glasgow, he left Messrs. Norman and became a pupil for three years to the late James Abernethy, past president of the Institution of Civil Engineers. During this pupilage Mr. Inglis was connected with dock and harbour work, which Mr. Abernethy was then engaged upon, and it was in this way that Mr. Inglis was stationed at and employed on the Alexandra railways and dock, Newport, Mon. From Newport he passed in 1875 into the service of the South Devon Railway, under the late P. J. Margary, M.Inst.C.E., then chief engineer of that line and also of the Cornwall Railway. Mr. Inglis's early employment at Plymouth was on the construction of the deep quays and waterworks at Millbay, and subsequently on the heavy doublings and works then in progress on the South Devon and Cornwall Railways. On the absorption of the South Devon Railway in 1878 by the Great Western, Mr. Inglis passed over to the staff of that system, but soon after retired to enter into private practice as a civil engineer at Plymouth.

During this period Mr. Inglis held various public posts and carried out engineering works of the most varied kind. In 1878 he was elected engineer to the Cattewater Harbour Commissioners, and built Mount Batten Breakwater, Plymouth; he was also called upon to undertake extensive quay and submarine work. Similarly, as engineer to the Sutton Harbour Company, Plymouth, he designed and carried out the large fish market there. Newlyn Harbour, Penzance, is another of Mr. Inglis's works, and it is interesting as an example of what can be accomplished by a combination of engineering and businesss knowledge. The Public Works Loan Board were interested in the work, with the result that to-day there is a safe harbour enclosing many acres, erected at a cost of some £60,000.

Mr. Inglis carried out the Torquay Harbour works under his old mentor, Mr. James Abernethy, who was consulting engineer, and had not finished these when in June, 1892, the directors of the Great Western Railway induced him to join that company as assistant engineer at Paddington. In the meantime, Mr. Inglis had carried out from time to time large works, such as the Princetown Railway, the Bodmin Railway, the Boscarne extension, as well as on the Great Western Railway itself, the reconstruction of the great South Devon viaducts at Cornwood, Ivybridge, and beyond, Marley tunnel, etc. This varied experience was soon to tell, for in October, 1892, or only four months after his arrival at Paddington, he was appointed chief engineer to the Great Western Railway. Since his appointment to this arduous office in 1892, Mr. Inglis has had little rest, as it is common knowledge that the extent of the improvements yearly carried out by this company, both as additions and alterations, have exceeded those of any other railway company in the kingdom. The average yearly sum spent on the Great Western Railway system on maintenance and new works between the years 1895 and 1902 inclusive, amounts to £2,000,000. From the above recital it will be seen that Mr. Inglis has for a lengthened period dealt with heavy issues and varied problems, an excellent training in conjunction with his intimate knowledge of a great portion of the Great Western's system, for the more responsible post of general manager to the Great Western Railway, which position he has occupied since the death of Sir Joseph Wilkinson in June, 1903.

Mr. Inglis is a lieut.-colonel in the Railway Staff Corps, and a member of the Council of the Institution of Civil Engineers.

MILAN EXHIBITION.

As already announced, to celebrate the inauguration of the new Simplon Pass, an exhibition will be held in Milan in 1906. All nations are invited to take part in the following sections: carriage by land, carriage by water, aeronautics, providential institutions, and decorative arts. The fine arts section is national. Applications to exhibit must all be handed to the executive committee by May 31st, 1905, with the exception of those relating to the fine arts. Machinery, heavy and bulky goods requiring motive power, foundations, erection or decorations are to be delivered by December 1st next.

The section to be devoted to carriage by land and aeronautics has been suggested by the realisation of the Simplon Tunnel, and the Simplon—in whose name Milan opens the exhibition of 1906—will naturally occupy the place of honour in it. The visitors will be enabled to gather detailed and direct information about the Simplon itself, the means by which it was conquered, its history, and its future as an international route.

Mr. George Bradley Wieland, chairman of the North British Railway Company, died at the Cap Martin Hotel, Mentone, on March 26th. He had formerly been secretary of the Company, and accepted the chairmanship in 1902.

The death is reported of Edward Longstreth, general superintendent of the Baldwin Locomotive Works. He did important work in perfecting the gauge system, and obtained a number of patents for various appliances In 1867 he was made general superintendent of the works, and in 1870 was admitted to a partnership.

THE NEW L.C.C. THAMES STEAMERS.

OF the paddle steamers undertaken by Messrs. John I. Thornycroft and Co., Ltd., at their Southampton works for the L.C.C. Thames service, the *Thomas More* and the *Gresham* were launched on Thursday, while almost ready to take the water are the *Francis Drake, Raleigh, Shakespeare* and *Ben Jonson.*

The vessels have been built of steel, under the supervision of the chief engineer of the London County Council, and to Lloyd's special survey, and are to be classed "A, for river purposes only," at Lloyd's Registry, and to have Board of Trade certificates for passengers and tonnage. The dimensions are as follows: Length between perpendiculars, 130 ft.; length overall, 134 ft; breadth moulded, 18 ft.; depth moulded, 7 ft. The boats will carry about 500 passengers on a light draft at a speed of 13 miles per hour.

Teak wood battened seats are fitted at the sides, supported by the rail stanchions. They have movable backs, similar to tram car seats, and are fitted athwartships at the centre line. Eight large buoyant raft seats are also fitted.

The steamers are steered from a raised platform amidships by patent steam steering gear placed on the main deck immediately below the platform, and actuated by a brass standard and wheel, being connected to a quadrant on rudder head below the deck by rods and chains running below the beams. The rudder is of the single plate type, and is attached to the stern post by portable gudgeons the stern post being tapered wood. The lines of the vessels are thus carried out to the after end of the rudder. The rudder post is carried up to the underside of the deck with a brass deck casting, with hinged lid, to allow a portable emergency tiller to be fitted, in case of breakdown of the steam stearing gear. Chadburn's engine room telegraph, and a compass, are fitted on the steering platform.

Special provision has been made for dealing with the embarking, and disembarking, of passengers. The gangway gates, of a somewhat novel construction, are four in number, with double gates opening outwards. The saloon companions are constructed of teak with double doors, and sliding tops, four feet in width in the clear, giving an easy entrance to the forward and aft saloons. The accommodation for passengers consists of two saloons under the upper deck.

The saloons are lighted by square windows at sides, every third window opening for ventilation. A large cowl headed ventilator is also fitted to each saloon for this purpose. The saloons are heated by steam radiators, and the vessels are lighted by electric light of sufficient power for reading purposes. An enclosed engine and dynamo is fitted in the engine room, the switch board being near the starting platform. The vessels have three watertight bulkheads. The crew's accommodation is forward, and the engineer's cabin in the engine room. The vessels are to be propelled by compound fixed diagonal surface condensing engines, having a working steam pressure of 110 lb. and constructed under the supervision of the chief engineer of the London County Council, Lloyd's surveyors, and the surveyors of the Board of Trade. The vessels are designed to attain a speed of 13 miles per hour. The paddle wheels, and all parts of the machinery, are of strong scantlings, to ensure freedom from the necessity of frequent overhauls. The boiler is constructed of Siemens Martin Steel, and fitted with Howden's system of forced draught, and generally in accordance with the most recent practice for shallow draft river steamers.

BLAST FURNACE RECOVERY PLANT.

By J. Gillespie

(Continued from page 691.)

EXHAUSTERS.

THE exhausters by which the gases are pulled forward from the furnaces and delivered outwards to pass through the final washers, have been of various types. I do not think the ordinary rotary exhauster in use in coal gas works has ever been used in blast furnace practice, probably as the number and size in this form would make the cost prohibitive. The form in use in many of the works is a modification of the Root's or rather Baker's Blower. But the most recent development of the exhauster is one which merits attention from its novelty and success. This is the turbine exhauster which has been successfully introduced at one works in Scotland, and is, I understand, shortly to be introduced at another; as its details have been very fully described in connection with an installation recently put down at Provan Gas Works in Glasgow. I will not enter into them, but merely state that the duty of each of the three turbines at Coltness Iron Works is 28,000 cubic feet per minute, at a pressure of 28½ in. of water, that is, 20 in. suction and 8 in. of pressure. The machine is actually doing more work than this, and the smoothness of its running and its efficiency are such as to give every satisfaction. The speed is about 7,500 revolutions per minute, and each turbine exhauster has replaced two double sets of the Baker blower type.

LIQUOR WASHERS.

The gas is pushed forward by the exhausters to the final washers, or liquor washers. Among the earliest forms of washer used was the one where dilute sulphuric acid was brought into direct washing action on the gas. The vertical scrubbers used in Messrs. Dempster's plants are an enlargement of the ordinary gas works, scrubber. These scrubbers require to be of large dimensions to deal thoroughly with the gas, and are consequently high in first cost. The filling material is usually rough boards placed on edge and so arranged as to form very fine channels for the passage of the gas;

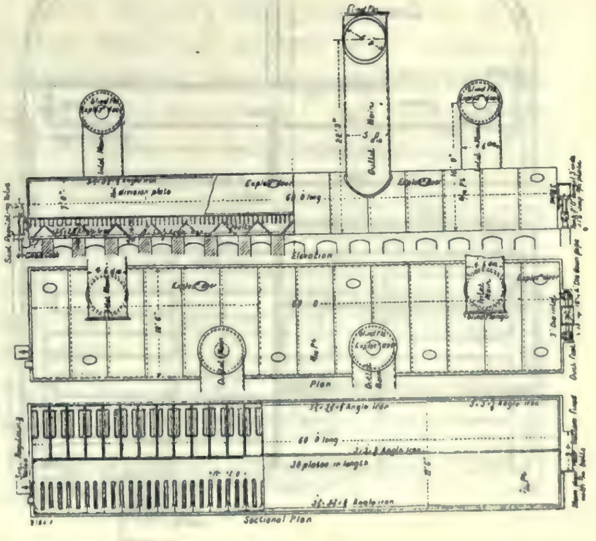


FIG. 2. ARRANGEMENT OF WASHER.

over these boards and down the channels a shower of water is kept in constant circulation.

The horizontal form of washer shown in fig. 2 is one which has given satisfactory results in several works. The general outline of the washer can be seen in fig. 2, while fig. 3 shows its cross section. The length of the washer varies with the quantity of gas to be passed; the section has always been kept a constant. The gas enters along one side as well distributed over the length of the vessel as possible; at a level of three feet above the bottom of the vessel there is placed a horizontal diaphragm stretching from side to side; along the centre of the vessel there is a vertical plate division reaching from the top to the horizontal diaphragm, so that the space on one side of the vessel above the diaphragm is entirely shut off from the corresponding space on the other side of the vertical division. Beyond this the action of the washer is exactly similar to that described in the case of the tar washer. But the effect of the exhausters on the washers is such that a fine spray of water is continually dashed up out of the outlet openings, and the outgoing gas is most intimately brought into contact with this spray. I have tested this action very carefully, by running these washers on air at the start of a new plant, and have seen the water spray rising six or eight feet out of any explosion door in line of the outlet openings.

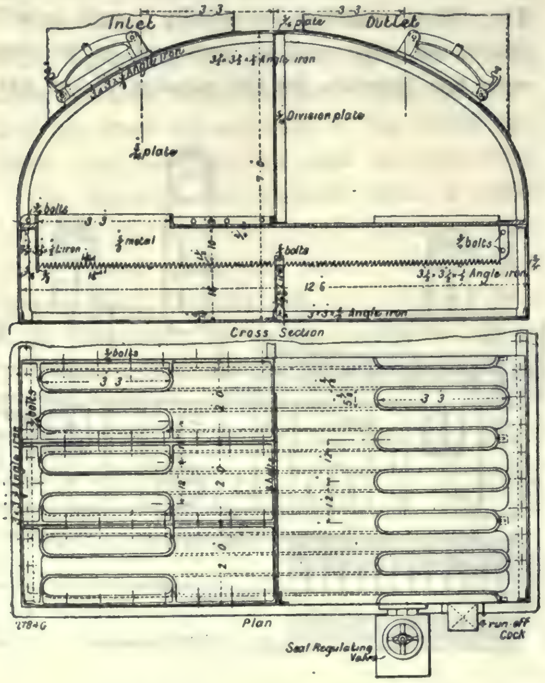


FIG. 3. CROSS SECTION.

The liquor washers are as already stated sometimes divided and placed one before and one after the exhausters, but the more frequent practice recently has been to put both on the pressure side. There is not much to choose between these arrangements, but probably the lubrication of the exhauster cylinders is easier, if no washing is done before the gas enters them, as the gas has sufficient lubricant in itself, but loses it in the light tar given up in the washers. Further I do not think the spraying effect will be so good if the gas is drawn through as when it is blown through.

The last of all the washers should be supplied with clean water as cool as can be procured, the effluent liquor from each washer being passed through a separator. The separation of the liquor from the tars is effected by means of the varying specific gravities. The tar from the condensers is mostly heavy or sunk tar lying below the liquor, while that from the liquor washers is floating or light tar of a green colour and frothy in appearance, this is probably due to bubbles of gas mixed in it through the spraying action in the washers, as if this light tar is allowed to lie for some time, it tends to sink down through the liquor. In some works the waste liquor from which the ammonia has been recovered is used in the washers over and over again, until it becomes about as high in gravity as the heavy tar and it is extremely difficult to separate them.

USE FOR THE GAS.

After the gas leaves the final washer it is carried away in the return main to the stoves, to the steam boilers, to the tar stills, and to any other purpose for which it can be used. These purposes are every day increasing in number, in some cases brick kilns are being fired with the gas; in others, kilns for ore briquettes are using part of the surplus gas; I have seen gas retorts heated by it, and the latest and most interesting use of all is that at Summerlee, where a large gas-driven blowing engine has been put into operation during the past month. I had the opportunity of inspecting this engine at work and was much struck with its substantial proportions and general appearance of being thoroughly well fitted for its work. A slight difficulty was experienced in freeing the gas supplied to this engine from the last traces of tar, but this has been entirely overcome and there is no reason to fear that the engine will in any way belie the very successful start it has made. This engine is one of 600 h.p. on the Delamare-Deboutville and Cockerill Patent system.

PLANT FOR RESIDUALS.

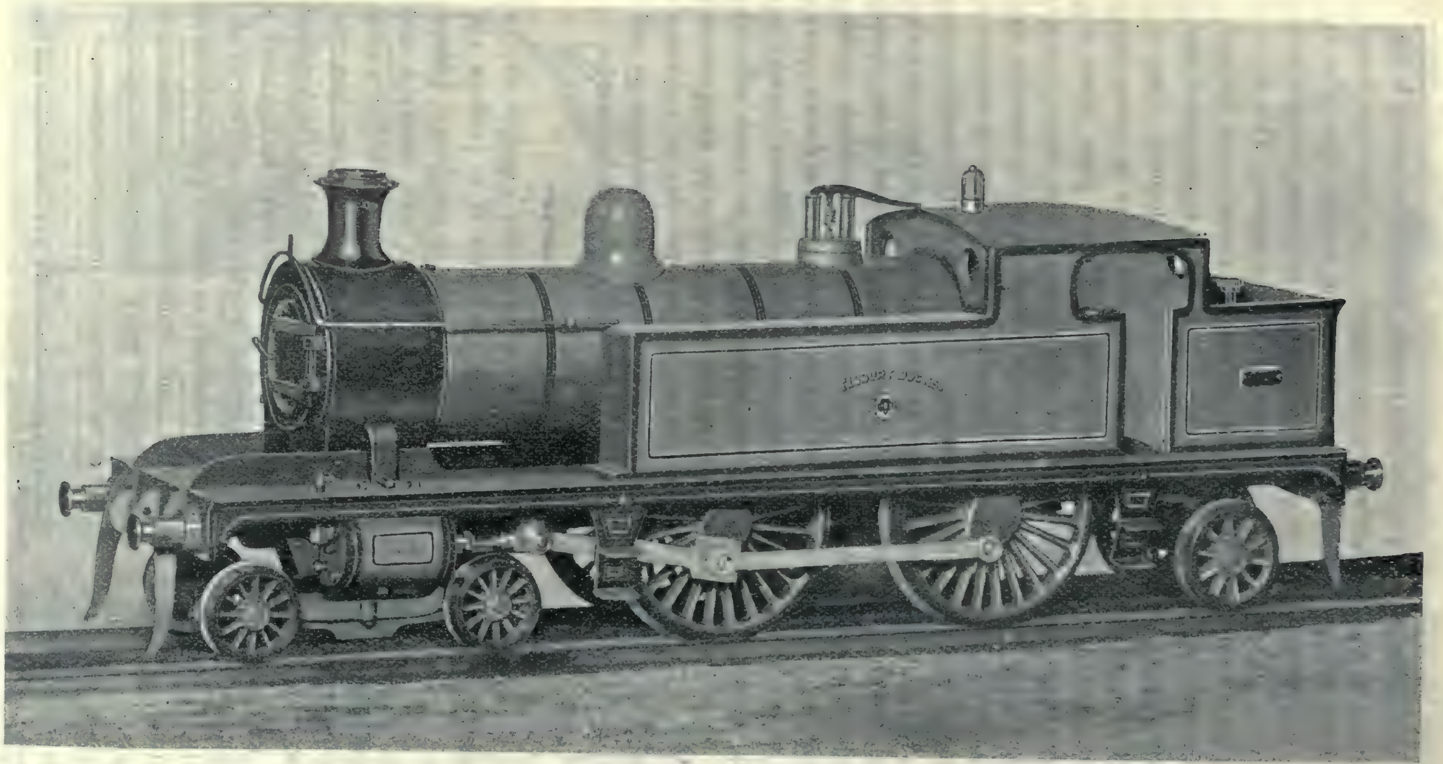
And now we have completed the general survey of the actually essential parts of the apparatus; what remains in the way of plant for working up the residuals is not necessarily a part of the plant proper, but is very much the same as is in use in works of similar character not connected with blast furnace practice. We find that we are left with tar dried in the primary washer and with ammonia liquor which even after repeated washings through the vessels is not very strong. The tar is distilled and worked up into pitch and oil. Various forms of stills are in use for this purpose, some horizontal and some vertical; they are fired with the gas from the furnaces supplied through specially designed burners.

The oil obtained is put into stock tanks and sent off in barrels or tank wagons, while the pitch is run out of the stills, cooled and broken up and sold in its broken state, or cast into blocks for convenience in handling and sometimes run into barrels, allowed to harden in the barrels, and so shipped. The ammonia liquor is treated in stills of the vertical type, and is stripped of its ammonia by steam brought into intimate contact with the liquor. This steam charged with ammonia is made to pass through sulphuric acid, till the acid is saturated and sulphate of ammonia salts formed. One of the many difficulties that occur in connection with a blast furnace recovery plant arises at this point of our survey. The waste liquor running from the ammonia stills contains in it certain ingredients which are deleterious to animal life. The works at Dalmellington lie near the classic waters of the Doon and all the waste liquors and drainage from these works is destroyed on the premises, being evaporated in a Porion furnace, fired with spare gas. Where possible this effluent liquor is used for the boiler feed and so, much reduced in quantity, but even then the evaporation of about 50,000 gallons per day is a serious matter. It will use quite as much gas as will drive the large blowing engine at Summerlee.

FINANCIAL ASPECT.

About the very important question of the returns from such a plant it is perhaps not advisable that I should say anything. I know that a well-equipped plant, well managed, and using suitable coal is capable of yielding a very handsome return on its first cost, but the variations in coals, in ores, and in the hundred and one things that go to make such a work a commercial success or otherwise, are so numerous, and it is so difficult to make a just estimate of favourable and unfavourable circumstances, that I think it much better not to speak of results or to attempt to make comparisons.

Abstract of a paper read before the West of Scotland Iron and Steel Institute.



FIVE-EIGHTHS SCALE MODEL OF LONDON, TILBURY AND SOUTHEND RAILWAY EXPRESS TANK-ENGINE, MANUFACTURED BY MESSRS. WRIGHT, CLARK, AND WALLIS.

A representative of PAGE'S WEEKLY has had an opportunity of inspecting some of the model railway engines and rolling stock which are now being manufactured at the Southwark Engineering Model Works. One of the latest of the firm's productions is the five-eighths inch scale model of the London, Tilbury and Southend Railway express tank locomotive, illustrated, which is claimed to be capable of hauling a weight of 140 lb. The model engine, which is a faithful reproduction of the original down to small details is manufactured in its entirety on the firm's premises in Southwark. It is made throughout of brass, gun metal, malleable iron, and aluminium castings, The boiler is tested as regards the inner barrel up to 120 lb. pressure, The outside cylinders are $\frac{7}{8}$ in. bore by $1\frac{1}{4}$ in. stroke.

A distinctive feature of the smaller model engines is that the firm have succeeded in producing model working locomotives to a $\frac{3}{8}$ in. scale with, it is claimed, as much perfection of detail as has hitherto only been found in $\frac{5}{8}$ in., $\frac{3}{4}$ in., and larger sizes. Of these small models a Midland tank engine and a Great Western express were run on the track on the occasion of our visit, and their hauling power amply demonstrated.

TECHNICAL SOCIETY NOTES.

THE discussion, at the Institute of Mechanical Engineers, last Friday, on Professor Capper's Report to the Steam Engine Research Committee elicited somewhat conflicting opinions. On the one hand everybody united in paying a tribute to the immense labour involved in the compilation of what Mr. Maw described as a "one man report," while, on the other hand, there was a tendency to relegate Professor Capper's six years' experimenting to the domain of scientific research. Yet, while the report only touches the fringe of the great subject of steam-engine research, undoubtedly Professor Capper has added to our knowledge of valve leakage, and although the experts are not ranged on his side, he claims that Messrs. Callendar and Nicolson's contention that the leakage is inversely as the overlap of the valve is at least in the main well founded, and that his investigation has established something approaching a law of leakage. Mr. Maw said that one of the most remarkable results brought out by Professor Capper's experiments was the very marked difference between leakage when the valve was lubricated as compared with no lubrication. As chairman of the Steam Research Committee Mr. Maw suggested that the best future for it might be amalgamation with the Steam Jackets Committee.

Professor Burstall held that leakage through valves was a most important steam-engine problem. If the researches of Professor Capper and Messrs. Callendar and Nicolson were to be relied upon it meant everything in the design of the engine. If there was a definite law in relation to valve leakage it was of the highest consequence that engine designers should know what that law was. He was afraid, however, that these experiments did not show the existence of any definite law, and to his mind did not confirm the theory that valve leakage was proportional to the difference of pressure or the overlap. If, however, the leakage was proportional to the difference of temperature it rather pointed to the leakage being due to a distorted valve, and Captain Sankey's experiments seemed to bear out that view. If one form of valve was less susceptible to warping than another, it was a circular valve. There could be no doubt that the question of valve leakage materially affected the economy of the engine, and he suggested a combination of experimenters on all forms of valve made of different materials with a view to ascertaining if the leakage was due to distortion, or if any law could be stated on which engine designers could really rely.

Happily, although Dr. Nicolson was not himself present, he communicated his views to the meeting. He thought Professor Callendar and himself had every reason to be satisfied with Professor Capper's results. He was of opinion that engine designers would be led to pay more attention to the valve question now that its importance had been again demonstrated. He pointed out that the leakage under working conditions was a more important factor than under experimental conditions, being frequently just twice as great. Mr. Mellanby thought it a pity that Professor Capper had not taken the temperatures of the valve faces, and Mr. Cavena pointed out that the figures quoted in the paper did not seem to confirm the opinion expressed that wire-drawing reduced the leakage.

Mr. Vaughan Pendred very much wanted to know what was the practical value of the paper they were discussing. In his opinion all such inquiries were futile, and that was the fault, not of Professor Capper, but of the steam-engine itself, the fact being that what was true of one engine was not true of any other engine, and that if Professor Capper were to repeat his experiments, even on the same engine, with altered conditions he would get an entirely different set of results. An engine was so easily upset; he might refer to an instance quoted by Mr. Willans in a paper read before the Institution of Civil Engineers, where a small quantity of water equal to about one tablespoonful having lodged in the bottom cylinder, made a most material difference in the whole performance of the engine. Another case was that of a very large pumping engine at Staveley put up by Mr. Davey. That engine pumped at one lift 810 ft., but because it was not fitted with drain cocks it did not make the required number of strokes. When this was done, however, the engine ran two strokes over contract, which showed what small things would affect the working of an engine.

Mr. Henry Davey said he had been chairman of the Steam Jackets Committee since its inception, and that committee had experimented with actual engines under working conditions, which was the only rational way of getting at the facts in practical engineering. Professor Capper's report was valuable from a scientific point of view, but hasty conclusions should not be drawn from it and applied in practice. The leakage question was, in his opinion, an incidental matter and not of the supreme importance of other facts brought out. Under practical working conditions there was not the leakage from valves that one would be led to expect from the investigation made with this small experimental engine. With regard to the suggestion put forward that the Steam Research Committee and the Steam Jackets Committee should be amalgamated, he quite agreed that it was useless for two committees to be working on what was practically the same subject, but if amalgamation did take place he hoped that before future experiments were undertaken the lines of investigation would be thoroughly discussed, and laid down with some definiteness.

An important question to which prominence has lately been given in the conclaves of the South African Association of Engineers is the electrical equipment desirable in a gold mine. Mr. S. R. Shellorn appeared to voice the general opinion when he remarked that it did not seem possible that small size stamp mills could be advantageously driven by electric motors. In the case of large stamp mills, however, he considered that a central electric power station would produce great economies. He suggested that the mill be driven in groups of 100 stamps by induction motors wound for high potential, and that the motors should be connected to the line shafts by means of rope drive. He also pointed out that the operation of small air compressors by means of electric motors has many advantages as compared with steam-operated compressors, whether separately installed or otherwise.

The voltage employed for distribution to small motors should be low, in order that the cost of repairs and upkeep should be small. An underground cable is much to be preferred to overhead distribution, in spite of its high cost, and such an underground system should consist of lead-covered and armoured cables. Galvanising steel armour is of no great advantage. Junction boxes should be installed underground with arrangement for disconnecting, in order to locate faults. In case of a fault in a section of shaft cable, it is cheaper to cut out the cable, put in a new length, and remove the damaged cable to the surface for repair and future use. He pointed out that each separate instance of power supply and distribution for mining purposes must be considered on its own merits, and carefully studied, but expressed confidence in the general proposition, that a large mine can be more economically operated from a central electric power station supplying power for all purposes, than by any other system or combination of systems.

Holborn and Finsbury Electrical Exhibition.

As already stated in a previous note, this exhibition has been organised by the County of London Electric Supply Company with a view to affording consumers and others an opportunity of inspecting the latest developments in connection with the application of electric energy to the driving of various types of machinery. The power section is the most important, since the company make a speciality of their power supply—especially in their northern area, which includes the big trading centres of Clerkenwell, St. Luke's, and Holborn. A special power circuit of 530 volts continuous is arranged for these districts, and a very large number of power users (about 7,000 h.p.) are connected to the company's mains, A special effort has been made at the exhibition to show the various trade machines in actually running order, including printing presses, refrigerating machinery, dough mixers, boot finishing machinery, clockmakers' lathes, etc., hoists, lifts, pumps, electro-plating, wood-working machines, etc.

The exhibition has been a decided success, the visitors including a large number of manufacturers, and others, technically interested in the various trades.

The photograph we reproduce this week gives a view of the sub-station equipment which had been arranged in the exhibition for supply to same. It consists of four 25-kilowatt "Brush" type transformers, with switch gear, similiar to that in use throughout the company's districts. In order to give the exhibitors an additional voltage a 25-h.p. 530-volt motor is connected to the company's power main, and drives a 200-volt generator. The joint boxes on view here are those used by the County Company. The supply available for exhibitors is two-phase 104 volt, 50 cycles; 530 volt continuous; 200 volt continuous—for power; 104 volt alternating for lighting purposes.

PENROSE AND CO.

This firm had a varied exhibit, including an electric passenger lift with switch cage control, electric goods crane, the new "Phœnix" drill, electric motors driving wood-working machinery, and an electrically-driven Colt's armoury press. The Penrose lifts and cranes are now well known, and are claimed to give great economy in running cost.

The firm also showed a new substance for electric treating to which the name "Kryptol" has been given. The property of "Kryptol" upon which its efficiency depends is the fact that it is designed to offer to an electric current the requisite degree of resistance to

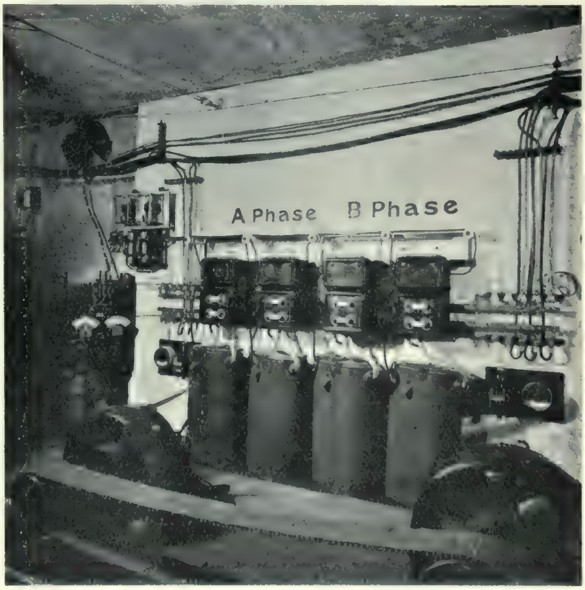


FIG. 1. VIEW OF SUB-STATION EQUIPMENT AT THE EXHIBITION.

generate heat, and that the material, which is a mixture of graphite carborundum and clay, remains unaffected for a considerable period.

SIMPLEX STEEL CONDUIT COMPANY.

This Company's system of steel conduits for electric wiring is, of course, familiar to those engaged in the industry, and the exhibition should have served to bring home its advantages to a wider public. The system consists of a combination of smooth bore steel tubes or conduits, used in conjunction with malleable cast-iron fittings and accessories, and has been designed with the object of effecting a general reduction in cost of efficient conduit wiring. Simplex conduits are manufactured in eight sizes. All simplex conduits can now be erected with permanent continuity or bonding, and they can therefore be efficiently earthed. Among the advantages claimed for the new screw socket junction are low cost and the prevention of cable twisting. The diameters of all conduits are said not to vary beyond limits of ·0025 of an inch.

B. WEAVER AND CO.

This firm showed a large variety of moulded ebonestos insulators, bobbins, bases, insulated terminals, handwheels, etc., etc. This material has now been on the market for five years, and it is claimed that with its use it is possible to obtain a thoroughly reliable insulator of great mechanical strength, and high resistance. It may be noted that it takes a beautiful finish.

ELECTRO MOTOR AND DYNAMO COMPANY.

This company had a conspicuous exhibit in the power section. Fig. 2 illustrates the pulley-block of the type recently supplied to the Admiralty.

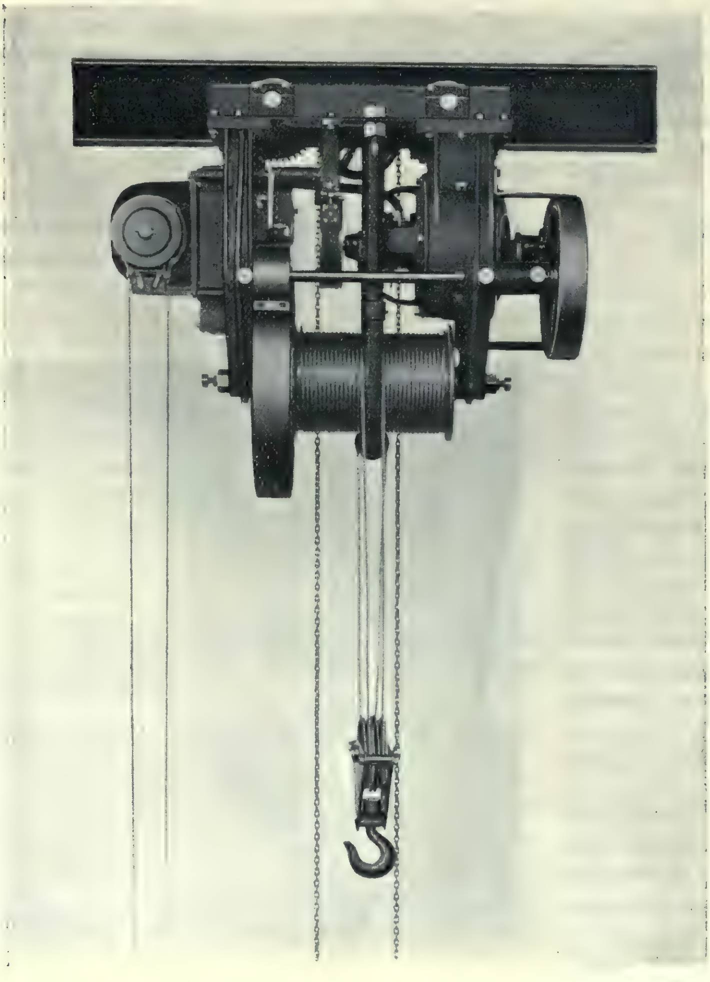
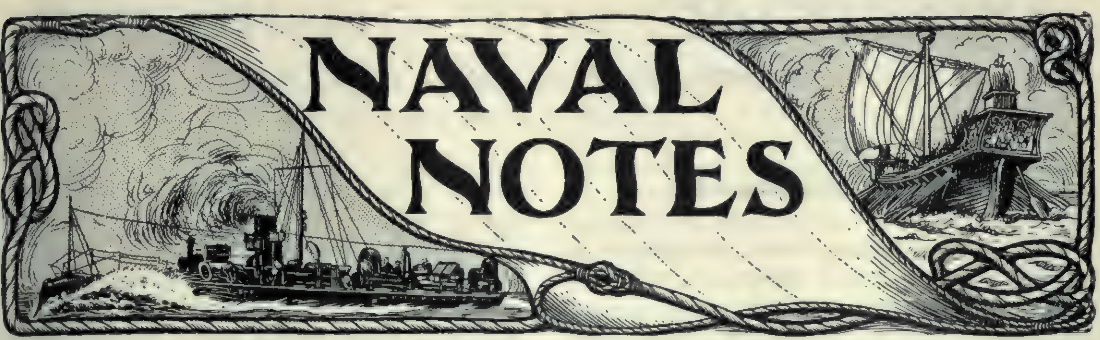


FIG. 2. ELECTRIC PULLEY-BLOCK, AS SUPPLIED TO THE ADMIRALTY.

The barrel of this pulley-block, which lowers and lifts the hook by means of two steel wire ropes, is directly connected to a 1-b.h.p. compound wound motor through double reduction machine-cut spur gear with a rawhide pinion on the motor, an electro-magnetic brake being fitted to the other end of the armature spindle, which comes into operation immediately the current is cut off or fails through any cause whatever. The whole is enclosed with sheet-iron covers and guards for the spur gearing, so as to make it a weather proof machine. The traversing motion of the trolley is done by means of a hand-chain and sprocket-wheel, on the spindle of which is a pinion gearing into spur wheels fixed on the same spindle as the trolley wheels. The controller is so arranged that unless the ropes are held, one for lifting and the other for the lowering motion, it returns to its central or "off" position. The illustration shows covers removed.

The ordinary pulley-blocks supplied by the company differ from the above in the fact that a barrel is used and two wire ropes instead of pitch-chain, and Otho worm gearing is employed, while an electro-magnetic brake is fitted instead of a friction motor retarding brake for lowering.



NAVAL NOTES

GREAT BRITAIN.

THE *New Zealand's* trials are proceeding satisfactorily, and she will be ready for the pennant very shortly. Laid down in February, 1903, only twenty-six months have been occupied in advancing her to her present state, which is practically one of completion, and that is well within the thirty months usually reckoned as the average time for the completion of a battleship. The *Britannia* also is progressing well, and most of her side armour is in position. The *Hibernia* will be launched on June 17th, and the Marchioness of Ormonde has agreed to perform the naming ceremony.

With the armoured cruisers also good progress is being made, the turntables and mountings for the three aftermost 9·2 in. guns of the *Duke of Edinburgh* have been placed in position. The armour-plating of the *Warrior* has also commenced, but the side armour is not yet in position.

In this connection it may be noted that Mr. Pretyman, answering Sir Gilbert Parker in the House of Commons last week, stated that in the first four years of the present century we had laid down thirteen battleships to six by France, ten by Germany, and six by Russia. Further, in November last, we had two more authorised but not begun, to Russia's three and Germany's two; France having then no more in contemplation. Again, Germany has in view a programme involving the construction of two battleships each year from 1906 to 1909 inclusive, one each year from 1910–1916, with the exception of 1913, when, as in 1917, two will be laid down. Mr. Pretyman also announced that Russia has a programme in preparation, but that details are not known.

GERMANY.

The two new battleships *Hessen* and *Preussen* of the *Braunschweig* class are ready to begin their trials, and will probably be commissioned in the autumn of this year, and the *Brandenburg*, of an old type, has been reconstructed and entered into service again.

The small cruiser *Munchen* on her trials has made a speed of 22 knots with 10,580 h.p.

ITALY.

Particulars of the design of the new armoured cruiser "A." which is to be built at Castellamare, have been published, and show that this vessel will be in length 425¾ ft., beam 68¼ ft., draught 23¼ ft. The maximum thickness of the belt will be 8 in., while the guns carried will be four 10 in., in pairs in turrets fore and aft, eight 8 in. in pairs in turrets on the broadside, sixteen 3 in., and eight machine guns. The engines will develop 18,000 h.p., giving a speed of 22·5 knots, and the coal carried will be from 700 to 1,500 tons. Her displacement will be 10,000 tons, and the cost is estimated at £880,000. A sister cruiser will be built at the same time and at the same yard. The first cruiser will probably be named the *San Georgio*, but the second is known at present as "B" only. The names of the torpedo boats building for the Italian navy are as follows: At Schichan, the *Sirio*, *Sagittario*, *Spica*, *Scorpione*, *Serpente*, and *Saffo*. At Odero, the *Orione*, *Orsa*, *Olimpia*, *Orfeo*, *Alcione*, *Ardea*, *Albatros*, *Aibone*, *Astore*, and *Arpia*. At Pattisons' yard, *Pegaso*, *Perseo*, *Procione*, *Pallade*, *Cigno*, *Cassiopea*, *Calliope*, *Clio*, *Centauro*, and *Canopo*. At Spezia, the *Gabbiano*.

FRANCE.

It is announced that the battleship *Liberté* will be launched on the 15th inst. She is of the *République* class, and has been built at Lorient. She has been about twenty months on the stocks, and it is therefore high time she took the water. The *Vérité* is the only other vessel of this class remaining to be launched.

The latest damage to the armoured cruiser *Leon Gambetta* does not appear to be very serious, but this vessel has been most unlucky on her trials. New propellers have had to be fixed, and the trials will be resumed shortly.

HOLLAND.

The following is the strength of the officers of the Dutch Navy, as voted for 1905 :—3 vice-admirals, 3 rear-admirals, 28 captains, 36 commanders, 120 lieutenants, 215 sub-lieutenants, and 68 midshipmen and cadets.

AMERICAN LOCOMOTIVE CONSTRUCTION.

TENDENCIES IN MODERN PRACTICE.

(*Continued from page* 698.)

LOCOMOTIVE PERFORMANCES.

TWO journeys were performed on the footplate for the purpose of making direct observations of the work of the biggest express engines: **1**, with a very fast train; 2, with a very heavy train.

1. The first journey was on the engine of the Pennsylvania Railway's 4.6 p.m. train from Camden to Atlantic City. This train was timed to run the distance of 58·3 miles in 54 minutes.

The line is a fairly level one throughout, what gradients there are being short and not severe. The worst is a four-mile rise of 1 in 196, beginning about eleven miles out of Camden. There is a sharp curve a mile or so after the start, necessitating a reduction of speed, but after this there is nothing worse than curves of 44 chains radius, and in one place the line is straight for 25 miles together.

A FAST TRAIN RUN.

The engine was a ten-wheeler, with four coupled wheels, 6 ft. 8 in. in diameter, a leading bogie and a pair of small carrying wheels under the footplate. The cylinders are 20½ in. in diameter, with a stroke of 26 in.; the steam ports are 20 in. long, and 1½ in. wide and the lap of the slide valve is 1⅛ in. The area of the grate is 55½ square feet, and the heating surface of the Belpaire fire-box 166 square feet; the boiler contains 315 tubes, 2 in. in diameter, and 15 ft. long, making the total heating surface 2,640 square feet. The engine weighs rather more than 81 tons in working order, of which 50½ tons rest upon the four coupled wheels. The eight-wheel tender fully loaded weighs 59 tons.

The train was composed of a twelve-wheel luggage van, two twelve-wheel Pullman vehicles, and four eight-wheel carriages, and weighed (exclusive of engine and tender, passengers and luggage) 229¼ tons. The weather was fine and there was little wind.

At the moment of starting steam was blowing off at 200 lb. per square inch; there was a thick fire (of coal, mostly in large lumps), right up to and above the level of the fire-hole behind and apparently of much the same thickness all over the flat gate. The start took place about a minute late; it was not possible to begin running hard till the sharp curve which is soon encountered had been passed over, but by the time the third mile post was passed the speed was already sixty miles an hour, and it had very nearly reached seventy-two when the four-mile bank of 1 in 196 was entered upon. This gradient had the effect of bringing down the speed to 65 miles an hour by the time the summit was reached. After this, on a road flat, or undulating gently with a falling tendency, 40 miles were run in twenty-nine minutes forty-six seconds, which gives an average speed for this distance of 80·6 miles an hour (90 miles an hour was not reached). All this time the engine ran quite smoothly. Steam was kept at or near the blowing-off point.

The fireman had to work fairly continuously, but did not appear to have more to do than one man could conveniently perform on so short a run. In the intervals of a few seconds when he was not firing, the fire-hole door was kept partly open. The regulator was from half to three-quarters open, and the reversing lever was in the fourteenth notch; there are in all thirty-two notches in the sector of the reversing gear; mid-gear, however, is not exactly in the middle, but somewhere about the seventeenth notch. Between mile posts 54 and 55 steam was shut off, and for some distance before stopping it was necessary to go quite slowly through the streets of Atlantic city. Eventually the train arrived one minute early, the whole distance of 58·3 miles from Camden having occupied fifty-two minutes five seconds, which makes an average speed of 67·1 miles an hour.

HEAVY TRAIN DUTY.

The second journey was from New York to Poughkeepsie on the engine of the New York Central Railway's 1 p.m. train for Chicago and other places. This train is always a very heavy one, and on the occasion in question was composed of ten twelve-wheel vehicles, weighing (without engine and tender) 480 tons. The engine was a ten-wheeler of the same general design as the Pennsylvania engine with which the last described run was performed. The driving wheels are 6 ft. 7 in. in diameter; the cylinders are 20½ in. by 26 in., with valves of the piston type with interior admission. The grate, which slopes downwards towards the front, has an area of 50 square feet; the fire-box contains a brick arch supported on water-tubes; there are two fireholes; the heating surface of the fire-box is 180 square feet, and the total heating surface 3,455 square feet. The centre line of the boiler is

9 ft. 3 in. above the rails. The weight of the engine in working order is eighty tons, and of the tender with ten tons of coal and 5,000 gallons of water, fifty-one tons. At the time of starting, the fire was about a foot and a half thick behind, gradually getting thinner towards the front under the brick arch.

On leaving the Grand Central Station in New York, the line almost at once begins to ascend at 1 in 94 through a partly covered cutting; this gradient continues for a mile or so. The engine made the ascent without skidding, and took about ten and a half minutes to reach 125th Street (4¼ miles). Starting again it was soon necessary to slow down over a bridge, and then near post 10 there is a sharp reverse curve where speed had to be reduced once more, so no good running could be done before the train stopped at Yonkers (15¼ miles from the starting point). Hence to Poughkeepsie, a distance of 58¼ miles, there is no stop. The line runs close beside the River Hudson almost all the way; as the tide is felt 150 miles from the mouth of this river, it follows that the railway is very level; there are a few short ascents and descents, but none of any importance. The first 5½ miles from Yonkers to Dobbs' Ferry took nine and a half minutes, and the next two miles to Irvington two minutes twenty-one seconds; after this, except for two slacks that took place, the speed kept between 55 and 60 miles an hour, the fastest piece being the nine miles before post 68, which were run in nine minutes eight seconds. All this time the regulator was wide open, and the reversing lever about four notches in front of the centre of the sector (there are in all about fifty notches in the sector). The fireman had to work really hard.

When steam was appreciably below the blowing-off point of 200 lb. per square inch (it fell once or twice to 170 lb.) he put on four shovels of coal in fairly big lumps every forty seconds alternately through either firehole, and when the pressure rose he put on bigger charges or rather smaller coal every minute or so; most of the fuel was put on at the back; between the charges the fire-doors were shut, but there is an arrangement for admitting a certain amount of air above the fire through the closed doors. Poughkeepsie was reached seventy minutes forty-two seconds from Yonkers, and the average speed had been 49¼ miles an hour. About three minutes in all had been lost by the two slacks. Water had been picked up twice during the run and at Poughkeepsie the engine was brought to a stand below a coal platform, whence a fresh supply of coal was let fall into the tender.

From a report by the Hon. Robert Collier, Third Secretary in His Majesty's Embassy at Washington.

LEEDS ASSOCIATION OF ENGINEERS.

At a meeting of the Leeds Association of Engineers, held on March 30th, a lecture was delivered by Mr. F. G. Heseldin on "Producer Gas-driven Plant *versus* Steam-driven Plant."

Referring to a recent case in which steam had been superseded by producer gas, he stated that the coal consumption had been reduced from 19 tons per week, at 13s. 6d. a ton, to 4½ tons, at 20s., notwithstanding that the output of the works had increased 23 per cent. For producer gas engines an ample margin of power should be allowed (at least 50 to 60 per cent. above the maximum normal load) to allow for difference in quality of gas due to bad firing, etc. The revolutions per minute of a 25 to 30 b.h.p. engine of 18-in. stroke should not exceed 190, and of an 80 b.h.p. engine of 20-in. stroke 180, but if 24-in. stroke, 160. Magneto-electric ignition should be adopted in preference to tube ignition with its timing valve, being far more reliable and easier to adjust. The exhaust valves for engines of 75 b.h.p. and upwards should be water-jacketed, i.e., the valve and its spindle should be hollow and water should circulate through it. A water spray pipe was an apology, as its action was local, and owing to the small size of the spray it frequently closed, causing the engine to stop. A starter should be used which would not explode the mixture, except when the engine was in motion and off the dead centre. For increased efficiency a very diluted mixture of power gas should be used, with a correspondingly increased compression. It was most unwise to entertain the offer of the maximum horse-power per ton weight, which some firms were making to capture the market. There could be no question that engines using producer gas would rapidly come into vogue for main driving. A good gas engine would give a thermal efficiency of 30 to 33 per cent., whilst the best steam engines had not exceeded 23 per cent. Another advantage was that the power could easily be distributed in mains from the producer to separate engines, thus dispensing with line shafts. With regard to the future, Mr. Heseldin anticipated that the problem would be solved in one of two directions: First, by corporate bodies supplying power gas at a cheap rate; and, secondly, by the invention of a simple medium-sized producer not working, as at present, with anthracite coal, but with common slack, from which all the tar could be eliminated, not necessarily as a by-product. That such a producer would be forthcoming there could be little doubt.

Manufactures of Greater Britain.

No. II.—AUSTRALASIA.

AT the Society of Arts on the 28th ult. the second lecture of the series was delivered by Mr. Walter James, Agent-General for Western Australia.

The following is an abstract of the engineering portion of the lecture :—

Australia has a population of 3,906,000, and New Zealand a population of 800,000. The present industrial position of the State of Victoria is perhaps the most advanced in manufacturing activity in Australia, and amongst other causes the main one has been its concentration of population in a comparatively small area, and in readily accessible centres. These conditions have enabled the local manufacturer to capture the home market so fully that he has secured a firm footing upon which to build an extra-State trade which is rapidly growing.

New Zealand contains a population of 800,000, and her area comprises 140,000 square miles ; and in her case, as with the case of Australia, though settlement may be relatively more concentrated than that of Australia, it is still so extended that the manufacturer finds himself under difficulties of the same kind though less in degree, in his competition with the oversea producer.

New Zealand is industrially independent in the sense that she is fiscally at arm's length from the Commonwealth. In that respect she stands to-day in the same relation to Australia that each State of the Commonwealth stood to the other before 1901. Whether between the Commonwealth and New Zealand reciprocal trade relations will spring up it is difficult to foresee, owing to the similarity of production, but it is impossible to believe that something will not be accomplished in this direction.

There is a capital of £73,000,000 employed in the 15,000 establishments, in which the work is conducted throughout the country. The horse-power actually employed amounts to nearly 200,000, and the value of machinery and plant to upwards of £25,000,000. The number of hands employed in factories is about 250,000 ; the main centres of activity being in Victoria, New South Wales, and New Zealand.

METAL AND MACHINERY.

Works connected with the treatment of metals, manufacture of machinery, agricultural implements, and railway rolling stock form a large and growing class of industry. About 42,000 hands are employed at this work, and about £4,000,000 represent the value of the machinery in the factories, which turn out, amongst other things, railway locomotives and rolling stock, galvanised iron and wire, agricultural implements, mining plants and machinery, but, with the exception of agricultural machinery, one of the few manufactured articles in which there is a fair volume of export trade, the output is to meet local demands, and all iron and steel used is imported. The local manufactures may be said to principally comprise very heavy foundry work, and goods for which sea carriage would be very expensive. In most cases where manufacturing successes have been made, it has been due to an understanding of special local conditions. A mine can be more cheaply equipped from an Australian foundry, because each mining field has its special requirements which are provided for by the local manufacturer; the same considerations apply to agriculture.

As an instance of special conditions which should be carefully noted, a small Victorian foundry has a large trade in picks with the Western Australian mines, because experience in the Victorian quartz mines has shown just where strength should be placed to get results. The pick was promptly copied by American competitors, but it was some time before any of the British travellers could get their firms to do so. It has, however, been copied by an English firm lately, after competition had made such advances that a change became vital if the trade was to be saved. Under this head the foreign competition against Great Britain is growing, chiefly from the United States of America, but also by means of a cheap cutting German trade.

The trade now possessed by the foreigner would nearly all pass into British hands if a preference were imposed. The import from America of some of their main lines (e.g., electrical machinery) cannot be affected by local manufacture for very many years, and is therefore an open trade for oversea competition, and the margin is so small that almost any preference would give an advantage which would secure the trade. The American trade, however, in agricultural machinery will steadily be overtaken by Australian makers because local conditions are specially catered for.

TWO MAIN TRADE FACTORS.

The last two years mark an epoch in Australasian manufactures, and the next ten will amply justify the hopes of those who believe in Australasia's industrial development. The country possesses the two main factors of success. She has first-class coal, and she has large deposits of rich iron ores. Australia exports to external countries about 1,000,000 tons of coal, and New Zealand exports nearly 200,000 tons; the industry is old and well established, and the quality of the coal well known. Iron ore is widely spread throughout both countries, and during the ensuing or next following session of the Federal Parliament provision will almost certainly be made granting a substantial bonus on the production of iron and steel from Australian ores in accordance with a recommendation made by a Royal Commission which dealt exhaustively with the subject. Australia cannot be said to possess water power available for extensive industrial purposes, but New Zealand has this power so well distributed that she would appear to offer ideal conditions for those manufactures to which water power is essential. Tasmania also has special capabilities in this direction.

Openings for Trade Abroad.

Servia.

A British vice-consular report from Belgrade gives notice of the intention of the Servian Government, at some not very distant date, to increase the railways of the country by branch lines. As yet, it has not been decided who is to be entrusted with the work of constructing the proposed lines; there is, however, a party who are desirous that the work should be carried out by native engineers and contractors, in which case there would be a large demand for the necessary material, the orders for which would be placed abroad.

Cape Colony.

According to a Capetown correspondent the following recommendations are contained in the report of the Harbour Board Commission: That authorised works absorbing about £126,000, be proceeded with as soon as possible; that authority be granted to the Harbour Board to spend another £60,000 for additional electric cranes; that the work on the quay wall and reclamation and the breakwater extension be proceeded with steadily after Parliament has seen fit to provide further sums on account of the £11,301,200 authorised in 1902, the £600,000 provided on account being nearly exhausted; that landing, shipping, and delivery continue to be undertaken by the Board, and that no efforts be spared to make the coaling arrangements such as will tend to tempt vessels not calling at Durban to coal at Capetown

Canada.

Hitherto, the commercial automobile has not been much in evidence on the streets of Toronto, but recent developments seem to indicate that the delivery of parcels and even heavy goods by the electric motor is a possibility in that city in the near future.

Transvaal.

The Municipal Council of Johannesburg are prepared to receive tenders for the supply and erection of Switchboards and accessories for their new direct and alternating current power station. General conditions, specification and forms of tender may be seen at the offices of the Council's consulting engineers, Messrs. Mordey and Dawbarn, 82, Victoria Street, Westminster, S.W., and may be obtained from them on payment of five guineas, which will be returned on receipt of a *bona fide* tender. Tenders are to be sent to the above address not later than noon on Thursday, April 27th, 1905.

LAUNCHES AND TRIAL TRIPS.

H.M.S. *Chelmer* returned to Southampton recently from the Clyde, where she has carried out her official speed and radius of action trials. She is the second vessel to complete her trials out of the fifteen similar ships ordered under the Navy Programme of 1903–4. The *Chelmer* is a twin-screw torpedo-boat destroyer of the 25½ knot *River* class. Length 225 ft., beam 23 ft. 10½ in., displacement 550–600 tons, i.h.p. 7,500–8,000. She was ordered from Messrs. John I. Thornycroft and Co., Ltd., on November 24th, 1903, and was built at their Chiswick yard, and has now returned to their Southampton works to receive her sea stores and equipment, and for examination before handing over to the naval authorities.

Messrs. S. P. Austin and Son, Ltd., have just launched at the Wear Dock Yard, Sunderland, the steel screw collier *Denewood*, for Messrs. Wm. Cory and Son, Ltd., of London, this being the fifteenth vessel constructed by them for the same owners. The *Denewood* is designed for shallow harbour work, and will be fitted with machinery by Messrs. George Clark, Ltd., of large power to enable her to make fast passages. The deadweight capacity of the vessel is 1,700 tons, and she will have Lloyd's highest class.

Messrs. Furness, Withy and Co., Ltd., Hartlepool, have launched the large steel screw steamer *Langoe*, which they have built to the order of Messrs. Bennetts and Co., Grimsby. The vessel is over 350 ft. in length, and has a cubic capacity of about 339,936. The vessel is built of Siemen's-Martin steel throughout, and takes Lloyd's highest class. Six powerful steam winches and patent steam and hand-steering gear by Furness, Withy and Co., Ltd., donkey boiler, direct steam patent windlass, and all the most modern improvements will be fitted. Cellular double bottom is fitted all fore and aft for water ballast, the after-peak also being available as a tank. Triple-expansion engines will be supplied and fitted by Messrs. Richardsons, Westgarth and Co., Ltd., Hartlepool, with cylinders 24 in., 39 in., 66 in., by 45 in. stroke, with two single-ended boilers, 16 ft. by 10 ft. 6 in. long working pressure. The christening ceremony was gracefully performed by Miss Ruth Bennett, daughter of Mr. F. S. Bennett, of Grimsby.

On the 23rd inst. Messrs. Workman, Clark and Co., Ltd., Belfast, successfully launched from their north yard the second steamer built by them for Messrs. Elders and Fyffes (Shipping), Ltd., of London. The *Zent*, like her sister ship the *Pacuare*, which was launched a few days ago, is 385 ft. long, and has been specially designed to assist in the rapidly extending fruit trade between the West Indies and this country. The holds of these vessels have been suitably insulated for the preservation of the largest fruit cargoes during transit, and are capable of accommodating over 50,000 bunches of bananas; also large consignments of oranges, limes, etc., as well as packages of coffee. For the purpose of keeping all this fruit in good marketable condition an efficient system of refrigerating plant, replete with the most up-to-date improvements, will be fitted, having ducts for the conveyance of cool fresh air to each compartment of the vessel, and, in addition, a very special scheme of ventilation has been arranged.

The triple-screw turbine yacht *Albion*, which has been a feature of such interest on the Tyne for some time past, sailed on Thursday night and arrived early on Saturday morning at Southampton. The yacht has been built by Messrs. Swan, Hunter, and Wigham Richardson, Ltd., for Sir George Newnes, Bart., M.P., and is from the design of Sir W. H. White, K.C.B. The machinery consists of turbines by the Parsons Marine Steam Turbine Company, driving three propellers. Before the vessel left the river she went through a long series of exhaustive trials, from which were gathered data which will prove of great value in the application of turbines to similar vessels.

INDIAN IMPORT TARIFF.

The import tariff of British India has lately been completely revised, and in future, articles imported into that country will be subject to the following duties: Engineering materials, 5 per cent. ad val.; rails, chairs, sleepers, and fishplates, other than those coming under the heading of railway material, 1 per cent., ad val.; zinc or spelter, 5 per cent. ad val. Coal, coke, and patent fuel will be admitted free, as also will railway material for permanent way, rolling stock, and ships, and other vessels for inland or harbour navigation, whether imported entire or in sections.

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts.

CONTRACTS OPEN.

Last Day.

Olton and Bordesley.—Widening of a portion of the line between Olton and Bordesley, about 2¼ miles in length, for the Great Western Railway Company. Engineer, Paddington Station ... ... April 11

Bantry (Ireland).—Execution of works for carrying out the scheme for providing an additional supply of water for the town of Bantry, for the Rural District Council, according to plans and specification deposited for inspection in the Board room of the Council. Mr. Richard Croly, clerk, Board Room, Bantry ... ... April 11

Cork. — Extension, enlargement, and improvement of Courtmacsherry pier, quay, and jetty, for the Cork County Council, according to plans and specifications prepared by Mr. R. W. Longfield, county surveyor, and lodged with Mr. E. Callanan, secretary, County Council, Courthouse, Cork ... . April 15

Foffanyreagh (Ireland).—Construction of a storage reservoir of about 75,000,000 gallons capacity at Foffanyreagh, near Newcastle, in the county of Down, for the Portadown and Banbridge Joint Water Board. Plans and specification may be seen at the office of Mr. R. H. Dorman, Court House, Armagh, or at the office of Mr. William Wilson, clerk to the Joint Board, Town Hall, Portadown April 17

Cardiff.—Following plant for their power station on the extra high-tension system, for the Cardiff Corporation, viz.: extra high-tension three-phase main switchboard for power station; switchboards for sub-stations; motor generators, rotary converters, etc. Mr. Arthur Ellis, borough electrical engineer, and manager, Central Office, The Hayes, Cardiff ... April 17

Batley.—The following works in connection with the extension of the tramways in Bradford Road, for the Corporation: (Contract No. 14) permanent-way construction and paving; (15) overhead equipment, steel poles, etc.; (16) feeder cables, conduits, and accessories. Messrs. Lacey Sillar and Leigh, 2, Queen Anne's Gate, Westminster, S.W. ... ... April 17

Glasgow.—Electric power generating and lighting plant for Clydebank Dock, for the Trustees of the Clyde Navigation. Mr. T. R. Mackenzie, general manager and secretary, 16, Robertson Street, Glasgow, or from Mr. Geo. H. Baxter, mechanical engineer ... ... April 17

Aberdeen.—Supply of one surface condenser, with air pump, oil separator, etc., for the Electricity Department. Mr. J. Alex. Bell, city electrical engineer, Corporation Electricity Works, Millburn Street, Aberdeen ... ... April 19

Last Day.

Merthyr Tydfil.—Construction of certain waterworks, consisting of an aqueduct from the existing Neuadd resorvoirs in the Taff Fechan Valley, and extending for a distance of about 16 miles towards the southern boundary of the district, for the Merthyr Tydfil Urban District Council. Mr. Geo. F. Deacon, 15, Great George Street, Westminster, S.W. ... ... April 19

Stockport.—Supply of one 500-k w. steam generator for the Gas and Electricity Committee. Mr. A. J. H. Carter, Electricity Works, Millgate, Stockport ... April 26

Croydon.—Deep-well pumping engine and boilers for the Stroud Green well, Woodside, Croydon, for the Croydon Town Council. Mr. Geo. F. Carter. A.M.I.C.E., borough engineer, Town Hall, Croydon... April 26

Manchester. — Construction of a new curve and the widening of a portion of their main line at Throstle Nest, Manchester, for the Cheshire Lines Committee. Mr. Harry Blundell, engineer to Cheshire Lines Committee, Central Station Liverpool ... ... April 27

Bishop's Stortford.—Carrying out of the following works at their sewage pumping station, for the Bishop's Stortford Urban District Council: (Contract No. 1) For supplying and fixing two Lancashire boilers, 18 ft. long by 6 ft. 6 in. diameter; (2) for supplying and fixing steam pumping engine and pumps. Mr. Thos. Swathebridge, 7, North Street, Bishop's Stortford ... ... May 8

New South Wales.—Tenders will be received at the office of the Secretary for Public Works, Sydney, Australia, up to 2 o'clock p.m. on Friday, September 1st, 1905, for the manufacture, supply and delivery in the State of New South Wales of all iron and steel required by the Government. Full particulars may be obtained from the Agent-General's office, 9, Victoria Street, London, S.W. ... Sep. 1

COMING CONTRACTS.

Edinburgh.—The Edinburgh District Lunacy Board have approved of a report by Messrs. Buchan and Hogarth on the power-station machinery and electric plant for Bangour. The probable cost of the whole works was estimated at about £15,000.

Southport.—It is estimated that the cost of laying the local telephone wires underground will be about £25,000.

Belfast.—Messrs. G. and J. Burns will shortly invite tenders for three new steamers for their Belfast and Ardrossan mail and passenger service.

London County Council.—It has been decided to lend the Battersea Borough Council £7,306 for electric lighting purposes, and the St. Pancras Borough Council £5,370 for electric light installation and meters. Various notices for extensions of mains in the Metropolitan area have also been assented to.

Lowestoft.—At Lowestoft an important dock extension is to be made. The Great Eastern Railway Company is constructing a new dock to accommodate the herring fleets, and it will adjoin the existing herring basin. A concrete retaining wall has been constructed next the quay head, and a new entrance is being pierced from the herring basin.

Long Eaton.—An inquiry has been held by Mr. R. H. Bicknell into the application of the Urban District Council for sanction to borrow £5,000 for electric supply purposes. The money is apparently wanted for new cables.

South Shields.—Tenders are shortly to be considered for constructing electric tramways.

Croydon.—Reports by Mr. George F. Carter, borough engineer, and Mr. George R. Strachan on a water scheme have been adopted. The estimated cost of the works, land, and parliamentary expenses is between £250,000 and £300,000.

Trent Navigation.—At the recent annual meeting the chairman stated that the directors had come to the conclusion that if a new lock could be put in below Newark they would, with a little additional dredging, be able to immensely improve their traffic. To make and equip such a lock would cost about £40,000, but the expenditure would be well repaid.

CONTRACTS CLOSED.

Toronto.—Messrs. Mackenzie and Mann, of Toronto, have ordered 20,000 tons of steel rails from Messrs. Bolckow, Vaughan and Co., of Middlesbrough, for the James's Bay Railway, to be delivered from May to September. The Canadian mills were unable to handle an order allowing so short a time for delivery, and British preference diverted the trade from Pennsylvania.

India.—The contract for a new bridge over the river Indus, at Khushalgarh, has been placed by the Secretary of State for India with the Tees-side Bridge and Engineering Works Limited, of Middlesbrough and London. The bridge, which has a double deck carrying the railway on the top, and a roadway below, consists of a cantilever span of 471 ft.—the slung portion being 261 ft. 8 in.—and an anchor span of 303 ft. The main girders are placed at 20 ft. centres, and have an overall depth of 52 ft.

Manchester.—Messrs. Hulse and Co. Manchester, we are informed, are turning their attention to the production of machine tools for steam turbine work. They have in hand a massive duplex crank shaft lathe, a boring machine, and planing machine.

Chelmsford. — Messrs. Clarkson, Ltd., Steam Car Works, Chelmsford, have received an order from the colony of Victoria, for four "Chelmsford" steam omnibus "chassis."

Penzance.—Messrs. Gwynnes, Ltd., of Hammersmith, have received an order from Lord St. Leven for a set of electrically-driven fire-service pumps to protect his castle at St Michael's Mount.

Great Northern Railway.—The Great Northern Railway Company have ordered two "Avonside" steam railway motor-cars from the Avonside Engine Company, Fishponds, Bristol, for delivery for summer traffic.

Glasgow.—The Fairfield Shipbuilding and Engineering Company Limited, of Govan, Glasgow, have placed an order with Messrs. Merryweather and Sons Limited, London, for a Merryweather double-cylinder steam fire engine, of the Greenwich type, capable of throwing four jets simultaneously.

Leeds.—The Corporation Water Works Committee decided to recommend the City Council to accept the tender of Messrs. R. MacAlpine and Co., of Glasgow, for the construction of Colsterdale reservoir, the tender being £297,000.

Derby.—The Tramways Committee have accepted the tender of W. Griffiths and Co. for extending the tramways at £18,689 2s. 9d., and that of the Brush Company for four tramcars.

Middlesex.—The Middlesex County Council have accepted the tender of the Metropolitan Electric Tramways to connect the Wood Green tramways with the lines at Bruce Grove, Tottenham. The Committee have also accepted the tender of Mr. Clift Ford at £6,711 for connecting Archway Road to Tally Ho Corner, Finchley, tramway lines, with car sheds at Woodberry Grove.

Hull.—The Corporation have accepted the tender of Siemens Brothers and Co., for the supply, etc., of mains and cables for twelve months ending March 31st, 1906.

Fulham.—The Council have accepted the tenders of the Worthington Pump Company for condensing plant at £2502, and the Sterling Boiler Company at £2,211, and the tender of E. Green and Son for economisers at £2,640.

APPOINTMENTS VACANT.

Last Day.

Ipswich. — The Ipswich Dock Commissioners are about to appoint a harbour and dock master. Salary, £275, and a house with office and clerk. Particulars from Mr. Henry C. Casley, clerk, Ipswich. April 8

Birmingham.—Tramway inspector under engineer. Salary at rate of £204 per annum. Mr. John Price, Council House, Birmingham ... ... April 12

Delhi, India.—Municipal engineer at Delhi. Engagement for five years at a salary equivalent to £600 per annum. Major C. J. Parsons, Deputy Commissioner, and President, Delhi Municipality ... ... —

APPOINTMENTS FILLED.

Leeds.—Mr. Charles G. Henzell is recommended by the Waterworks Committee for appointment as waterworks engineer in connection with the construction of Colsterdale reservoir at a salary of £1,000. The work will occupy ten years.

Lancashire and Yorkshire Railway Co.—The directors of the Lancashire and Yorkshire Railway Company have appointed Mr. David C. Rattray, at present assistant engineer, to be chief engineer in the place of Mr. W. B. Worthington, who has been appointed engineer-in-chief to the Midland Railway Company. Mr. A. Watson, resident engineer to the company at Bolton, has been appointed the assistant engineer.

Adelaide.—Mr. Eldin S. Moulden has been appointed an instructor in electrical engineering at the South Australian School of Mines and Industries, Adelaide.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies.

STOCK EXCHANGE SETTLING DAYS.—Settling days on the Stock Exchange are as follows:—
Consols May 4th, June 1st. General Settlements: April 13th, 28th, May 12th. Bank Rate, March 9th, 1905, 2½ per cent.

1.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
11,370	5	5%	Alldays & Onions Pneumatic Engineering, Ltd.	3	2¾ — 3*
10,000	5	3/-	Do. Cum. Pref. 6 per cent. ..	5	4⅜ — 4⅞*
3,210,000	1	1/-	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	$3\frac{5}{16}$ — $3\frac{7}{16}$*
76,970	5	2/-	Do. 4% Cum. Pref.	5	5⅜ — 5⅝*
1,500,000	100	4%	Do. 4% 1st Mort. Dbs. Rd.	100	101 — 103
£100,000	100	4½%	Aveling and Porter, Ltd., 4½% Reg. Mt. Debs. Red.	100	96 — 99
530,000	1	1/7⅕	Babcock and Wilcox, Ltd., Ord. ..	1	5⅛ — 5⅜
100,000	1	7⅕d.	Do. " 6% Cum. Pref.	1	1⅜ — 1⅝
20,000	5	3/-	Baker (Joseph) and Sons, Ltd., 6% Cum. Pref.	5	4¾ — 5¼*
250,000	1	6⅗d.	Baldwins, Ltd., 5½% Cum. Pref. ..	1	1 — 1⅛
£250,000	Stk	4½%	Do. 1st Mt. 4½% Deb. Stk. Red.	100	101 — 103
150,000	4½	2/8⅖	Barrow Hæmatite Steel Co., Ld., O.	4½	1⅜ — 1⅝
50,000	4½	6/-	Do. do. Cum 2nd. Pref.	4½	4⅜ — 4⅝
33,334	5	2/6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares	5	4¾ — 5¼*
£500,000	100	—	Beardmore (Wm.) & Co., Ltd., 4½% 1st Mt. Debs., Red., Scrip 50% pd	—	103 — 105
50,000	10	6/-	Bell Brothers, Ltd., 6% Cum. Pref.	10	11¾ — 12¼
£366,600	Stk	4%	Do 4% Deb. Stock, Red.	100	99 — 101
200,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	$\frac{7}{16}$ — $\frac{9}{16}$
300,000	1	6⅗d.	Do. 5½% Cum Pref.	1	⅝ — ¾
£300,000	Stk	4½%	Do. 4½% Red. Deb. Stock	100	96 — 99
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760	1	1 — $1\frac{1}{16}$
1,860,900	1	3⅗d.*	Do. Nos. 1,639,101-3,500,000	12/-	$\frac{17}{32}$ — $\frac{19}{32}$
1,160,000	1	4½d.	Brown (John) and Co., Lim., Ord., Nos. 1-1,160,000	15/-	$1\frac{3}{16}$ — $1\frac{5}{16}$
590,000	1	6d.	Do. Ord., Nos. 1,160,001-1,750,000	1	$1\frac{25}{32}$ — $1\frac{27}{32}$
74,000	10	5/-	Do. 5 % Cum. Pref.	10	11 — 11½
154,500	5	5/-	Cammell, Laird & Co., Ltd., Ord. ..	5	8¼ — 8½*
232,500	5	2/6	Do. 5% Cum. Pref. ..	5	5⅛ — 5¼*
450,000	1	1/6	Clayton & Shuttleworth, Ltd., Ord.	1	1 — $1\frac{1}{16}$
70,000	5	2/6	Do. 5% Cum. Pref.	5	5½ — 5¾
£250,000	Stk	4%	Do. 4% 1st Mort. Db. Stk. Red	100	100 — 102
100,000	10	7/6	Consett Iron Co., Ltd., Ord.. ..	7½	32 — 33
57 031	10	10/-	Crossley, Bros., Ld, Ord. 40340/97370	10	16 — 16¼
40,339	10	5%	Do. 5% Cum. Pref.	10	11¾ — 12
75,000	1	2/6	Delta Metal, Ltd. Shares	1	2 — 2¼
1,259,594	1	8⅗d.	Dorman, Long & Co., Ltd.	1	⅝ — $\frac{11}{16}$
£400,000	Stk	4%	Do. 4% 1st Mort. Perp. Deb. Stk.	100	91 — 94
200,000	5	3/-	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating..	5	3⅜ — 3⅝
250,000	1	9⅗d.	Dunlop (James) & Co., Ltd., Ord...	1	½ — ⅝
300,000	1	7⅕d.	Do. 6% Cum. Pref. ..	1	⅞ — $\frac{15}{16}$
4,721	13	12/-	Ebbw Vale Steel, Iron & Coal Co., Ltd.	13	9½ — 10½
69,754	13	12/-	Do. do. do.	10	7¾ — 8
20,250	10	8/-	Elliott's Metal, Ltd.	8	4½ — 5½
5,000	10	5%	Do. Cum. Pref. 5%	10	8¾ — 9¼
186,748	Stk	4%	Do. Deb. 4%	100	94½ — 96½
25,000	10	6/-	Fairfield Shipbuilding & Engng. Co., Ltd., 6% Cum. Pref. ..	10	10¾ — 11¼
£250,000	Stk	4½%	Do. 4½% Mort. Deb. Stk. Red.	100	100 — 103
9,000	10	10%	Fleming & Ferguson, Ltd, Ord. Nos. 1/9000..	10	12 — 12¼*
6,000	10	5%	Do. 5% Cum. Pref. Nos. 9001/15000	10	9½ — 10
126,000	8	3/-	Fraser & Chalmers, Ltd., Ord. ..	8	4⅝ — 4⅞
21,000	3	1/6	Do. 7½% Cum. Pref.	3	5¾ — 6¼
10,000	10	5%	Galloways, Ltd., 5% Cum. Pref. 18001/28000	10	6 — 7
£150,000	Stk	4%	Do. 4% 1st Mort. Deb Red..	100	90½ — 91½
16,800	10	—	Greenwood & Batley, Ltd., Ord. ..	10	4¼ — 4½
9,600	10	7%	Do. 7% Cum. Pref.	10	10¼ — 10¾
965,000	1	1/-	Guest, Keen & Nettlefolds, Ltd. Ord.	1	2⅜ — 2½
344,000	5	2/6	Do. 5% Cum. Pref.	5	5⅞ — 6⅛
£1,850,500	Stk	4%	Do. 4% Irred. Mort. Deb. Stk	100	107 — 109
18,000	5	2/6	Gwynnes, Ltd., 5% Cum. Pref. ..	5	2 — 3
250,000	1	3/6	Hadfield's Steel F'dry Co., Ld., Ord.	1	3⅛ — 3¼
20,000	10	4/6	Do. 4½% Cum. Pref.	10	10¾ — 11¼
30,000	5	3/-	Hall (J. & E.), Ltd. 6% Cum. Pref...	5	5 — 5½
408,505	1	1/6	Harvey United Steel Co., Ltd. ..	1	1¼ — 1⅜
47,500	10	7½%	Hawthorn, Leslie & Co., Ltd. Ord.	10	10¾ — 11
28,001	5	7/-	Head, Wrightson & Co., Ltd. ..	5	5 — 5½
85,000	1	7⅕d.	Hill (Richard) & Co. (1899) Ld., Ord.	1	$\frac{11}{16}$ — $\frac{13}{16}$
18,000	5	3/-	Do. 6% Cum. Pref.	5	4¾ — 5
30,000	10	6/-	Hornsby (Richard) & Sons, Ld., Ord.	8	5½ — 6

ENGINEERING, IRON, AND STEEL COMPANIES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices
750,000	1	6d.	Howard & Bullough, Ltd., Ord. ..	1	1⅝ — 1¾
25,000	10	6/-	Do. 6% Pref. (Non-Cum.) ..	10	13 — 13½
£250,000	Stk	4%	Do. 4% Deb. Stk., Red. after 1905	100	98 — 101
37,500	10	20	Kynoch, Ltd.	10	18½ — 19½
49,537	10	5%	Do. Cum. Pref. 5%	10	10¾ — 11
300,000	1	4⅘d.	Lambert Bros., Ltd., Ord.	1	⅝ — ⅞
50,000	5	2/9	Do. 5½% Cum. Pref.	5	4 — 4½
40,000	3	2/1⅕	Leeds Forge Co, 7% Cum. Pref. ..	3	3¾ — 4¼
200,000	1	7⅕d	Lysaght (John), Ltd., 6% Cum. Pf.	1	$1\frac{5}{16}$ — $1\frac{7}{16}$
£300,000	Stk	4½%	Do 4½% 1st Mt. Deb. Stk., Red.	100	109 — 111
40,000	10	5/-	Mather & Platt, Ld., 5% Cum. Pref	10	11 — 11½
210,000	1	8⅖d.	Measures Bros., Ltd., Ord.	1	$\frac{9}{16}$ — $\frac{11}{16}$
75,000	1	6⅗d.	Do. 5½% Cum. Pref.	1	$\frac{13}{16}$ — $\frac{15}{16}$*
£75,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	92 — 95*
21,943	5	2/6	Muntz Metal, Ltd.	5	5⅜ — 5⅝
14,248	5	5%	Do. Pref. 5%	5	4¾ — 5¼
5,000	62½	47/6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref.	62½	76 — 80
73,000	10	5/-	N. Brit. Loco. Co., Ltd., 5% Cm. Pf.	10	12 — 12¼
80,000	5	—	North-Eastern Steel Co., Ltd., Ord.	5	—
£250,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	90 — 93
122,000	5	1 6	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	3⅞ — 4⅛*
50,000	5	3/-	Do. 6% Cum. Pref. "A" ..	5	5⅞ — 6¼*
70,000	10	6/-	Pease & Partners, Ltd., Ord. ..	10	9¾ — 10¼
£400,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	98 — 101
20,000	5	3/-	Peebles (Bruce) & Co., Ld., 6% Cm. P.	5	4⅞ — 5⅛*
65,000	1	—	Pooley (Henry) & Son., Ltd., Ord ..	1	6/- — 6/6
13,000	5	—	Do. 5½% Cum. Pref.	5	4 — 4¼
230,000	1	—	Projectile Co. (1902), Ltd., Ord. ..	1	⅜ — ½
126,938	5	2/-	Rhymney Iron Co., Ltd.	5	1⅝ — 2
73,062	5	2/-	Do. New	5	1½ — 1¾
£330,000	—	5%	Do. 5% Mort. Deb., Red. ..	100	101 — 103
350,000	1	7⅕d.	Richardsons, Westgarth & Co., Ltd., 6% Cum. Pf. ..	1	⅞ — $\frac{15}{16}$*
£350,000	Stk	4½%	Do. 4½% Perp. Deb. Stock ..	100	94 — 96
35,000	10	12/-	Ruston, Proctor & Co., Ltd... ..	10	9½ — 10
275.000	1	6d.	Scott (Walter), Ltd., Ord.	1	$\frac{13}{16}$ — $\frac{15}{16}$
300,000	1	7⅕d.	Do. 6% Cum. Pref. ..	1	1 — 1⅛
£300,000	Stk	4%	Do. 4% Perp. Deb. Stk.	100	94 — 96
£115,300	100	5%	Shelton Iron, Steel and Coal Co., Ld. 1st Charge 5% Debs.. Red ..	100	92 — 95
£97,900	100	6%	Do. 6% 2nd Mort. Debs., Red.	100	91 — 95
250,000	1	1/-	South Durham Steel & Iron, Ltd. Or.	1	⅝ — $\frac{11}{16}$
300,000	1	1/2⅖	Do. 6% Cum. Pref...	1	$\frac{27}{32}$ — $\frac{29}{32}$
£300,000	Stk	4½%	Do. 4½% Per. Deb. Stock	100	89 — 92
49,560	10	2½%	Steel Co. of Scotland Ord. 1/49560..	9	5¼ — 5⅜
£125,240	Stk.	5%	Do. 5% Trust Mort. Deb. ..	100	106½ — 107½
25,000	10	—	Stephenson (Robert) & Co., Ltd., Or.	10	2¼ — 2¾
25,000	10	5/6	Do. 5½% Cum. Pref. ..	10	4¼ — 4¾
£250,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	78 — 81
85,000	10	9/-	Stewarts & Lloyds, Ltd., Ord. ..	10	17¾ — 18¼
55,000	10	6/-	Do. 6% Cum. Pref.	10	14¾ — 15¼
634,732	1	6d.	Swan, Hunter & Wigham-Richardson, Lim. Ord.	1	¾ — ⅞
538,845	1	6d.	Do. 5% Cum. Pref.	1	⅞ — 1
£240,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	98 — 101
300,000	1	6d.	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cum. Pf.	1	½ — $\frac{9}{16}$
£200,000	100	4%	Do. 4% Irredeem. 1st Mort. Deb.	100	69 — 72
£160,000	1	7⅕d.	Thornycroft (John I.) & Co., Ltd. 6% Cum. Pref.	1	$\frac{13}{16}$ — $1\frac{1}{16}$
10,000	10	5/-	Tylor (J.) & Sons, Ltd. 5% Cum. Pf.	10	9½ — 10
$508495200	$100	$½	United States Steel Corp. Com. Stk.	$100	37¼ — 37½
$360314100	$100	$1¾	Do. 7% Cum. Pref. Stock	$100	99¾ — 100
$162268000	$1000	5%	Do. 10-60yr. 5% Skg. Fd. G. Bds.	$1000	97 — 99
3,350,000	1	1/6	Vickers, Sons & Maxim, Ltd. Ord..	1	2⅜ — 2½
750,000	1	6d.	Do. 5% Non-Cum. Pref. ..	1	$1\frac{3}{16}$ — $1\frac{5}{16}$
£750,000	Stk	5%	Do. 5% Non-Cum. Pref. Stock.	100	117 — 120
£1,250,000	Stk	4%	Do. 4% 1st. Mort. Deb. Stk. Red.	100	106 — 108
£1,000,000	100	4½%	Do. 4½% 2nd Mort. Debs., Red.	100	106 — 108
225,000	1	1/2⅖	Weardale Steel, Coal & Coke, Ltd., Def. Ord.	1	¾ — ⅞
500,000	1	7⅕d.	Do. 6% Cum. Pref. Ord. ..	1	⅞ — 1
£300,000	Stk	4%	Do. 4% Perpetual Deb. Stock	100	85 — 89
7,637	5	2/9	Weldless Steel Tube, Ltd., Cum. Pref. 5½	5	4⅜ — 4⅞
300	Stk	4½%	Do. Mort. Deb. 4½%	100	92 — 98
66,666	5	3/.	Willans & Robinson, Ord.	5	1 — 2
66,666	5	3/-	Do. 6% Cum. Pref.	5	2 — 3
£246,641	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red	100	75 — 80
£150,000	Stk	4½%	Yorkshire Iron & Coal Co., Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	81 — 86

Stocks and Shares marked * are quoted ex-dividend.

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
70,000	1	6d.	Alliance Elec. Co., Ltd. 5% Cum. Pf.	1	⅝—⅞
125,000	1	7⅕d.	Aron Elec. Meter Ltd., 6% Cum. Pf.	1	7/16—9/16
120,000	1	1/2⅗	Bell's Asbestos Co., Ltd.	1	¾—⅞*
100,000	5	4/-	British Insulated & Helsby Cables Ltd., Ord.	5	5½—6*
100,000	5	3/-	Do. 6% Cum. Pref.	5	5½—6
£500,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	101—104
£200,000	Stk	4½%	British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	99—101
400,000	5	3/-	British Westinghouse Electric and Manufac. Co., Ltd., 6% Pref.	5	2⅞—3⅛
£616,353	Stk	4%	Do. 4% Mort. Deb. Stk. Red.	100	91—93
105,731	2	2/-	Brush Elec. Enging. Co., Ltd., Ord.	2	½—¾
150,000	2	2/4⅘	Do. 6% Pref.	2	1½—2
£125,000	Stk	4½%	Do. 4½% Perp. 1st Deb. Stk.	100	92—95
£125,000	Stk	4½%	Do. 4½% Perp. 2nd Deb. Stk.	100	79—82
35,000	5	5/-	Callender's Cable & Constn. Ltd. Ord.	5	11—11½
40,000	5	2/6	Do. 5% Cum. Pref.	5	5½—5¾
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red.	100	107—109
85,000	3	1/6	Crompton & Co., Ltd.	3	2⅛—2⅜
£100,000	—	5%	Do. 5% 1st Mort. Reg. Debs.	100	93—98
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord.	5	8—8½
61,000	5	3/-	Do. 6% Cum. Pref.	5	5¾—6*
£300,000	Stk	4½%	Do. 4½% Deb. Stock, Red.	100	105—107
233,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1⅛—1⅜
£233,334	Stk	4%	Do. 1st Mort. 4% Free. Deb. Stk.	100	106—109
99,261	5	1/6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261	3	1—1¼
17,139	5	2/6	Do. "A" Shares Nos. 01-017,139	5	1¾—2¼
£344,023	Stk	4%	Do. 4% Deb. Stock Red.	100	80—85
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Red.	100	85—90*
112,100	2	1/7½	Electric Construction Co., Ltd.	2	1⅛—1¼
31,390	2	2/9⅗	Do. 7% Cumulative Pref.	2	2¼—2½
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	97—99
10,248	10	7/6	Evered and Co., Ltd.	10	12—14
£100,000	Stk	5%	Ferranti, Ltd., 5% 1st Mort. Deb. Stock, Red.	100	90—95
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9½—10
£200,000	Stk	4%	Do. 4% 1st. Mt. Deb. Stk., Red.	100	97—101*
35,000	5	10/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	12¼—12¾
35,000	5	2/3	Do. 4½% Cum. Pref.	5	5⅜—5⅝
£50,000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Red.	100	109—111
50,000	10	5/-	India Rubber, Gutta Percha & Telegraph Works Co., Ltd.,	10	16—17
£300,000	100	4%	Do. 1st Mort. Deb. Red.	100	100—103*
7,500	10	—	Parker, Thos., Ltd.	10	6½—7
100,000	1	3%	Scott (Ernest) & Mountain, Ld., Ord.	1	16/3—16/9
37,350	12	24/-	Telegraph Construction and Maintenance Co., Ltd.	12	36—38
£150,000	100	4%	Do. 4% Deb. Bonds	100	103—105

III.—ELECTRIC TRACTION.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
120,000	5	3/-	Anglo-Argentine Trams Co., Ld., Or.	5	8⅝—8⅞
260,007	5	2/6	Do. 5% Cum Pf.	5	5⅝—5⅞
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888	100	140—143
20,000	10	6/-	Barcelona Trams Co., Ltd., Ord.	10	12—12½
10,000	10	5/-	Do. 5% Cum Pf. Shares	10	9—10
£46,300	100	5%	Do. 5% Debs., Red.	100	99—102
£191,326	Stk	4½%	Do. 4½% Red. Deb. Stk.	100	96—100
75,606	1	—	Bath Elec. Trams. Ld., Pf. Or.	1	13/16—15/16
59,394	1	11·49d	Do. 5% Cum. Pf.	1	15/16—1 1/16
75,000	5	—	Brisbane Electric Tram Investment Co., Ltd., Ord.	5	1—1½
75,000	5	2/6	Do. 5% Cum. Pf.	5	3¾—4¼
£425,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	94—98
£200,000	Stk	6%	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock	100	104—107
		%	Pref. Ord. Stock	100	100—103
133,301	10	6/-	Brit. Electric Traction, Ltd., Ord.	10	9¼—9¾
156,437	10	6/-	Do. 6% Cum. Pref.	10	10⅞—11⅛
£1,000,000	Stk	5%	Do. 5% Perp. Deb. Stk.	100	121—123*
£250,000	Stk	4½%	Do. 4% 2nd Deb. Stk. Red.	100	98—100
100,000	5	1/6	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	3¾—4
40,500	5	3/-	Do. "A" 6% Cum Pref.	5	5⅝—5⅞
27,000	5	3/-	Do. "B" do.	5	5⅜—5⅝

ELECTRIC TRACTION.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£200,000	Stk	5%	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Red.	100	97—99
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	101—105*
102,268	5	3/-	Calcutta Tramways Co., Ltd.	5	8¾—9
£350,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	106—108
480,000	1	6d.	Cape Electric Tramways, Ltd.	1	1⅜—1⅝
40,000	5	2/6	City of Birmingham Trams Co., Ltd. 5% Cum. Pref.	5	4⅞—5⅛
£300,000	100	4%	Do. 4% 1st Mort. Debs.	100	101—104
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red.	100	103—105
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord.	10	13½—14½
59,987	10	6/-	Do. 6% Pref.	10	15½—16½
30,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	3—3½
£150,000	Stk	4%	Do. 4% Deb. Stock	100	89—92
125,000	10	5/-	London United Trams. (1901), Ltd., 5% Cum. Pref.	10	10—10½
£1,031,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	99—102
£50,000	Stk	5%	Madras Electric Trams (1904), Ltd., 5% Deb Stock, Red.	100	101—103
314,016	1	—	Metropolitan Elec. Trams, Ltd., Def.	1	13/32—15/32
500,000	1	6d.	Do. 5% Cum. Pref.	1	1—1 1/16
£350,000	Stk	4½%	Do. 4½% Deb. Stock, Red.	100	105—107
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	½—1½
110,923	8	3/2⅖	North Metropolitan Tramways Co.	8	3¾—4¼
£150,000	100	3½%	Do. 3½% Mort. Debs.	100	90—95
£196,200	Stk	5%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red.	100	105—108
24,500	10	10/-	Potteries Elec. Traction Co., Ld., Or.	10	9¾—10¼
24,500	10	5/-	Do. 5% Cum. Pref.	10	9½—10
£220,000	Stk	4½%	Do. 4½% Deb. Stk., Red.	100	103—107

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
7,500	10	14/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord.	10	11½—12*
7,500	10	4/6	Do. 4½% Cum. Pref.	10	9¾—10¼
7,500	10	6/-	Do. 6% Cum. Second Pf.	10	11—12
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red	100	105—107
14,000	5	2/-	Bromley (Kent) Elec. Lt. & Pr. Co. Ld	5	5¼—5¾
£50,000	Stk	4½%	Do. do. 4½% 1st Deb. Stk. Red.	100	103—106
27,507	5	5/6	Brompton & Kensington Elec. Supply Co., Ltd. Ord.	5	9½—10½*
12,493	5	3/6	Do. 7% Cum. Pref. Shares	5	9½-10½*
60,000	5	3/-	Calcutta Elec. Sup. Cor. Ltd., Ord.	5	9—9¼
£288,782	Stk	4%	Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk.	100	105—108
70,000	5	4/-	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord.	5	7½—8½
80,000	5	2/3	Do. do. 4½% Cum. Pref.	5	5⅜—5⅝
£350,000	Stk	4%	Do. do. 4% Deb. Stk. Red.	100	105—107
41,436	5	3/9	Chelsea Elec. Sply. Co., Ltd., Ord.	5	6½—7
£150,000	Stk	4½%	Do. do. 4½% Deb. Stk., Red	100	109—111
70,595	10	7/-	City of London El. Lghtg. Co., Ld., O.	10	11½—12
40,000	10	6/-	Do. 6% Cum. Pref.	10	13½—14
£400,000	Stk	5%	Do. 5% Deb. Stk., Red	100	123—127
£300,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Red	100	103—105
40,000	10	5/-	County of London Elec. Supply Co., Ltd., Ord.	10	9—9½*
30,000	10	6/-	Do. 6% Cum. Pref.	10	12—12½*
£400,000	Stk	4½%	Do. 4½% Deb. Stk., Red.	100	110—113
70,000	5	2/6	Edmundson's Elec. Cor. Ltd., Ord.	5	6—6¼
70,000	5	3/-	Do. 6% Cum. Pref.	5	6⅛—6⅜
£300,000	Stk	4½%	Do. 4½% 1st Mort. Db. Stk. Reg	100	106—108
£80,000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red.	100	86—91
10,000	5	2/-	Folkestone Elec. Supply Co., Ld., O.	5	5½—6
£50,000	Stk.	4½%	Do. 4½% 1st Deb. Stk., Red.	100	101—104
15,000	10	—	Havana Electricity Co., Ltd.	10	9½—10½
13,000	5	3/6	Hove Elec. Lighting Co., Ltd., Ord.	5	7¾—8¼
£50,000	Stk	4½%	Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red.	100	101—103
150,000	1	—	Kalgoorlie Electric Power & Lighting Corp, Ltd., 6% Cum. Pref.	1	11/16—13/16
21,000	5	7/-	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord.	5	12½—13

Stocks and Shares marked * are quoted ex-dividend.

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£135,000	Stk	4%	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	101 —103*
111,000	3	1/9⅗	London Elec. Supply Corp., Ld., Ord.	3	2½ — 3
60,000	5	3/-	Do. 6% Pref.	5	5¾ — 6
£371,895	Stk	4%	Do. 4% 1st Mort. Db. Stk., Red.	100	99 —101
100,000	10	11/-	Metropolitan Elec. Sup. Co., Ld., Or.	10	18 —18½
76,121	5	2/3	Do. 4½% Cum. Pref.	5	5⅝ — 5¾
220,000	Stk	4½%	Do. 4½% 1st Mort. Db. Sk., Red.	100	110 —115
250,000	Stk	3½%	Do. 3½% Mort. Deb. Stk., Red.	100	97 — 99
£250 000	—	4½%	Midland Elec. Corp. for Power Distribution, Ld., 4½% 1st Mort. Deb.	100	99 —101
10,852	10	8/-	Notting Hill Elec. Ltg. Co. Ltd. Ord.	10	14½—15½
£59,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	100 —102*
16,500	5	4/6	Oxford Electric Co. Ltd., Ord. ..	5	6¼ — 6½
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	98 —100
£81,700	100	4½%	Royal Elec. Co. (of Montreal) 4½% 20-yr. 1st Mort. Deb	100	98 —100*
40,000	5	9/6	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	13¾—14¼
20,000	5	3/6	Do. 7% Pref...	5	8¼— 8¾
£150,000	Stk	3½%	Do. 3½% Deben. Stock, Red	100	98 —100
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2⅝— 3⅛
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	79 — 83
65,000	5	4/-	South London Elec. Sup. Co., Ltd. O.	5	4 — 4¼
100,000	1	—	South Metropolitan Elec Light & Power Co., Ltd. Ord.	1	⅞ — 1
50,000	1	8⅖d.	Do. 7% Cum. Pref.	1	1 5/16—1 7/16
£100,000	Stk	4½%	Do. 4½% 1st Deb. Stock Red.	100	105 —108*
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	4 15/16—5 1/16*
30,000	5	2/6	Do. 5% Cum Pref.	5*	5⅛— 5¼*
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	104—106*
110,000	5	7/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	12½—13
28,151	5	2/6	Do. 5% Cum. Pref.	5	6¼— 6¾

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£34,800	100	4%	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red.	100	99 —102
25,000	10	—	Amazon Telegraph Co., Ld... ..	10	2¼ — 2¾
£763,580	Stk	17/6	Anglo-American Tel. Co., Ltd., Ord.	100	61 — 63
£3,118,210	Stk	35/-	Do. 6% Preferred Ordinary	100	108 —109
£3,118,210	Stk	2/-	Do. Deferred Ordinary ..	100	15⅞—16⅛
44,000	5	3/-	Chili Telephone Co., Ltd.	5	6⅝— 6⅞
$15,000,000	$100	$2	Commercial Cable Co., Capital Stk.	$100	230 —240
£1,903,856	Stk	4%	Do. Sterl. 500-yr 4% Deb. Stk., Red.	100	97 — 99*
16,000	10	5/-	Cuba Submarine Tel. Co., Ld., Ord.	10	8¾— 9¼
6,000	10	10/-	Do. 10% Preference	10	17 — 18
6,000	5	2/-	Direct Spanish Telegraph Co., Ord.	5	3⅜— 3⅝*
		5/-	10% Cum. Preference	5	8½— 9*
£30,000	50	4½%	Do. 4½% Debs...	50	101-103%
60,710	20	3/-	Direct U.S. Cable Co., Ltd... ..	20	11⅜—11⅝
£85,800	100	4½%	Direct West India Cable Co., Ltd., 4½% Reg. Debs.	100	100—102
£300,000	100	4%	East. & S. African, Ld., 4% Mt. Dbs.	100	100—102
£200,000	25	4%	Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy)..	25	101-103%
300,000	10	2/6	Eastern Extension, Australasia and China, Ltd...	10	14¼— 14¾
£602,400	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	105 —107
£4,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord. ..	100	143 —146
£2,000,000	Stk	17/6	Do. 3½% Pref.	100	92 — 94
£1,836,814	Stk	4%	Do. 4% Mort. Deb.	100	108 —110
150,000	10	5/-	Great Northern Telegraph Co., Ltd., (of Copenhagen) ..	10	38½— 40½
£58 700	100	4½%	Halifax and Bermudas Cable Co., Ltd., 4½% 1st. Mort. Debs. Red.	100	100—102
17,000	25	12/6	Indo-European Tele. Co., Ltd. ..	25	49 — 51
72.680	1	7½d.	Monte Video Telephone Co., Ltd., O.	1	13/16 — 15/16
£1,983,338	Stk	6%	National Telephone Co., Ltd., Pref.	100	109 —110
£1,966 667	Stk	5%	Do. Deferred	100	102 —104
250,000	5	2/6	Do. 5% Non-Cum. 3rd Pref.	5	5½ — 5¾
£2,000,000	Stk	3½%	Do. 3½% Deb. Stk., Red. ..	100	100—102
£689,593	Stk	4%	Do. 4% do. do. ..	100	103½—105½
179,313	1	7½d.	Oriental Telephone & Elec. Co., Ltd.	1	1¼ — 1⅜
50,000	1	7½d.	Do. 6% Cum. Pref.	1	1 3/16 — 1 5/16
£100,000	100	4%	Pacific & European Tel. 4% Guar. Debs. Red...	100	98 —101
11,889	8	4/-	Reuter's Telegram Co., Ltd. ..	8	7¼— 7¾
58,000	5	3/-	United River Plate Telep. Co., Ltd.	5	7 — 7½
40,000	5	2/6	Do. 5% Cum. Pref.	5	5 — 5¼
£179,947	Stk	5%	Do. 5% Deb. Stock, Red. ..	100	107—109
15,609	10	4/-	W. African Telegraph Co., Ltd. ..	10	8 — 8½
£30,008	2½	—	West Coast of America, Ltd. ..	2½	[illegible] — 1 7/16
150,000	100	4%	Do. 4% Deb. Guar. by West. Tel.	100	100 — 102

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
88,321	10	6d.	W. India & Panama Teleg. Co., Ld., Or.	10	⅞— 1
34,563	10	6/-	Do. 6% Cum. 1st. Pref. ..	10	8½— 9
4,669	10	6/-	Do. 6% Cum. 2nd Pref. ..	10	8 — 8½
£80,000	100	5%	Do. 5% Deb.	100	103 —105
207,930	10	3/-	Western Telegraph Co., Ltd. ..	10	13¾ —14¼*
£75,000	100	5%	Do. 5% Debs., 2nd Series, 1906	100	101 —103
518,915	Stk	4%	Do. 4% Deb. Stock, Red. ..	100	103 —105

VI.—SHIPPING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5½% Cum. Pref.	10	8¾— 9¼
£325,000	Stk	4½%	Do. 4½% Red. 1st Mort. Deb. Stk.	100	100—102
£672,900	Stk	4½%	British & African Stm. Nav. (1900) Ltd., 4½% 1st Mort. Deb. Stk., Red.	100	96 — 98
40,000	10	5/6	Bucknall Steamship Lines, Ltd., 5½% Cum. Pref.	10	5¾— 6¼*
£600,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk.	100	79 — 82
£750,000	Stk	4½%	Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. ..	100	100 —102
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000..	20	12 — 13
40,000	20	8/-	Do. Nos. 60,001-100,000	10	4¾— 5¼
£461,430	Stk	4½%	Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. ..	100	101 —103
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord...	1	1¼— 1⅜
25,328	7½	4/7	Gen. Steam Navigation Co., Ld., Ord.	7½	5 — 5½
36,758	8	4/9⅗	Do. Non-Cum. 6% Pref.	8	8 — 8½
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	100—102
55,000	5	1/3	Houlder Line, Ltd., Ord.	5	2¼— 2¾
40,000	5	2/9	Do. 5½% Cum. Pref.	5	3 — 3½
£200,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk. Red.	100	83 — 86
141,500	10	5/-	Leyland (Fredk.), & Co., (1900), Ltd., 5% Cum. Pref. ..	10	5¼ 5¾
£1,160,000	Stk	5 %	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. ..	100	132 —136
£1,160,000	Stk	19%	Do. do. Deferred ..	100	229 —232
15,000	100	30/-	Royal Mail Steam Packet Co. Ord..	60	25½— 26½
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref..	5	4¾— 5¼
39,075	5	2/6	Do. "B" Ord...	5	4 — 4½
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord..	10	8¼— 8¾
24,000	10	4/6	Do. 4½% Cum. Pref... ..	10	10¼— 10¾
£1,008,894	Stk	4%	Do. 4% Debenture Stk., Red.	100	100 —102

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
60,000	1	9⅗d.	Chadburn's (Ship) Tele. Ltd., Ord...	1	1— 1⅛
£750,000	Stk	9%	General Hydraulic Power Co., Ltd.	100	130 —135
12,500	10	10/-	Oakey (John) and Sons, Ltd., Ord..	10	24 — 26
10,000	10	6/-	Do. do. 6% Cum. Pf.	10	14 — 15
183,538	1	6·3d.	Power Gas Corp., Ltd., Ord., Nos. 66,463-250	15/-	5/16— 7/16
66,462	1	8·4d.	Do. do. Nos. 1 66,462	1	9/16— 11/16
135,000	1	6d.	Waygood (R.) & Co., Ltd., Ord. ..	1	1 1/16— 1 3/16
135,000	1	7½d.	Do. 6% Cum. Pref. ...	1	1⅛— 1¼

RAILWAY CARRIAGE & WAGON COMPANIES.

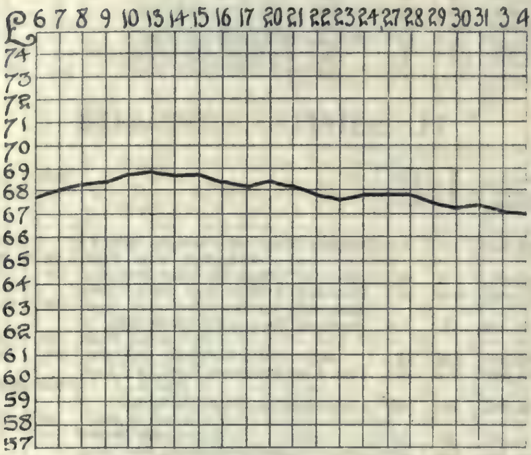
Present Amount Subscribed,	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
10,000	10	7/6	Birm. Railway-Car. & Wagon, L., 1-10,000	10	21 —22
8,739	10	3/-	Do. Second Issue 1-8,739....	4	8¾ — 9
10,000	10	6/-	Do. Cum. Pref. 6% 1-10,000..	10	13 —13½
30,111	7	7/-	Gloucester Rail.-Car & Wagon, Ld., A, 1-29,861 & 49,751-50.000	7	9 — 9¼
44,889	7	3/6	Do. B, 29,862-49,750, 50,001-75,000	7	3⅞ — 4⅛
14,567	10	1/3	Lancashire Wagon, Ord.	2	[illegible]
4,150	10	5%	Do. do.	10	10¼ 10¾
781,808	1	9d.	Metropolitan Amalgamated Rail.-Carriage & Wagon, Ld., 1-784,808	1	41/6—42/3
164,288	1	6d.	Do. Cum. A Pref. 5% 1-164,288	1	23/6—24/6
235,000	1	7½d.	Do. Cum. B Pref. 6% 1-235,000	1	27/6—28/6
20,000	20	20/-	Midland Rail.-Car. & Wagon, Ld., 1-20,000	10	18½—19½

Stocks and Shares marked * are quoted ex-dividend.

THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM MARCH 6TH TO APRIL 4TH, 1905.

COPPER.



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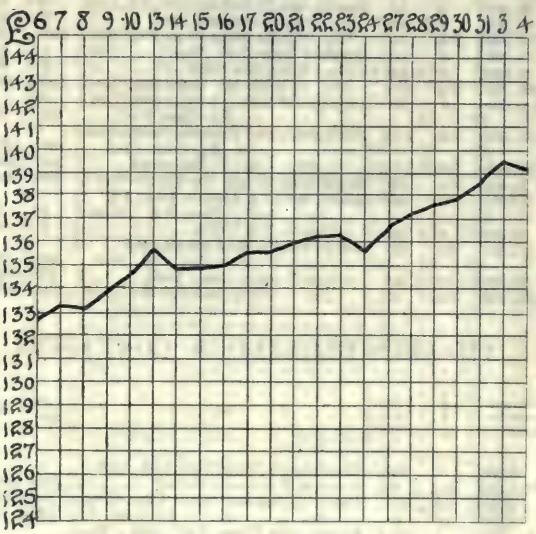
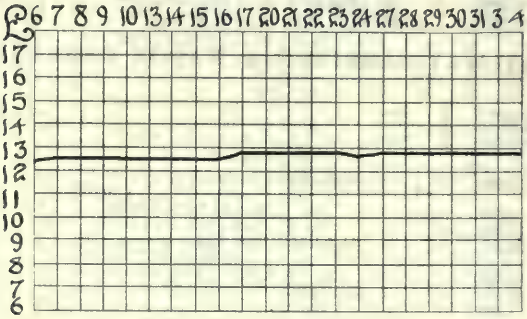


ENGLISH LEAD.



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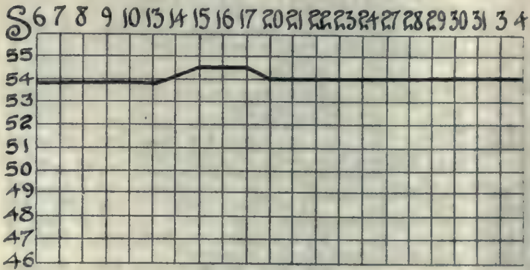

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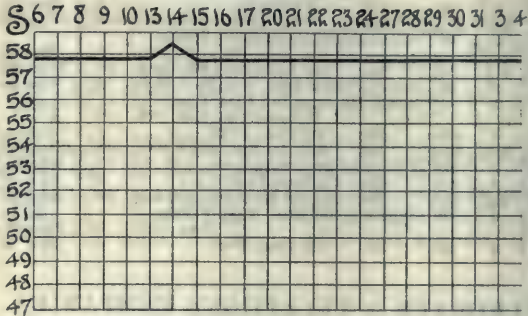
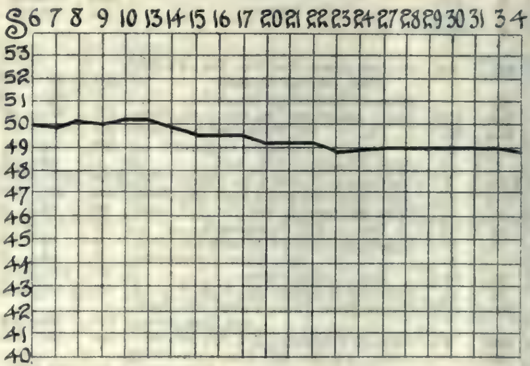


CLEVELAND.



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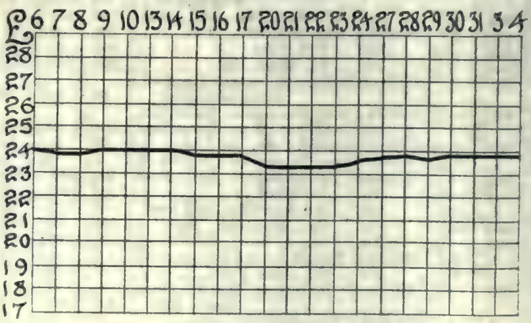


PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, April 5th, 1905.

A GOOD deal of disappointment has been expressed by holders of copper at the course of quotations, for although American trade advices have been fairly satisfactory, the market here has been dull and neglected. The fortnightly figures show a decrease in the visible supply of 364 tons and an increase in standard stocks of 327 tons. The total deliveries, including 14,484 tons North America to the Continent, are 21,497 tons for the month, against 32,027 for March 1904. The price yesterday closed at £66 17s. 6d. cash and £67 2s. 6d. three months.

Readers have been made acquainted with the main cause for the rise in the value of tin during the past month. The improved quotation is due, of course, to the decline in the supply of Banca tin, but many are inclined to think that in this instance there is a proper want of proportion between cause and effect. As recently as the end of February, foreign tin was below £130 per ton, and it is now quoted at over £139, with a prospect of reaching £140 in the immediate future. One has to go back some years to find a parallel to the present price, but it is admitted that the present movement is less the outcome of speculation than was then the case. It is reported that in Holland the market is practically bare of spot tin, and it would need but little speculative manipulation to bring about a fresh rise. The important point is that in many of our manufacturing industries a rise in price to the present level produces something approaching dislocation of trade, and it is to be hoped that the present high rates will stimulate production, and relieve manufacturers from the fear of famine prices for the metal. The closing price yesterday was £139 5s. spot, and £134 10s. three months. The short Banca supply is now admittedly due to the scarcity of coolie labour.

The better tendency in Lead which has been in evidence for some time past still prevails, and although business remains on a comparatively small scale sellers are holding out for higher prices and quotations are again somewhat firmer.

Spelter exhibits some recovery, all the cheap parcels offering having been absorbed so that the market has a decidedly better appearance. The closing price is £23 15s. for Ordinaries.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal :—

Steel :		£	s.	d.
DALZELL ♛♛ STEEL	Siemens' Steel Plates, Marine Boiler Quality	6	15	0
	,, ,, ,, Land ,, ,,	6	17	6
	,, Steel Bars, Boiler Quality	6	17	6
DALZELL ♛ STEEL	Siemens' Steel Plates, Ship Quality Plates	5	17	6
	,, ,, Bars ,, ,,	6	7	6
	,, ,, Angles	5	7	6

Manufactured Iron :

	£	s.	d.
Bars—Dalzell	6	2	6
,, Best	6	12	6
,, ,, Horseshoe	6	12	6
,, Angle	6	2	6
,, Best Angle	6	12	6
,, Best Best	7	2	6
,, Extra Best	7	12	6

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

The Glasgow Iron and Steel Co., Ltd., Wishaw, quote as under (prices are delivered Glasgow or equal) :—

	£	s.	d.	
Steel Angles (Glasgow ♛ Steel)	5	7	6	per ton.
Steel Ship Plates (Glasgow ♛ Steel)	5	17	6	,,
Steel Bars, Ship Quality (Glasgow ♛ Steel)	6	7	6	,,
Steel Bars, Boiler Quality (Glasgow ♛ ♛ Steel)	6	17	6	,,
Steel Land Boiler Plates (Glasgow ♛ ♛ Steel)	6	7	6	,,
Steel Marine Boiler Plates (Glasgow ♛ ♛ Steel)	6	7	6	,,

Less 5 per cent. discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

John Spencer (Coatbridge), Ltd., Phœnix Ironworks, Coatbridge, N.B., quote :—

	£	s.	d.
Bars—Phœnix	6	5	0
,, Best	6	15	0
,, Best Best	7	5	0
,, Extra Best	7	15	0
,, Best Horse Shoe	6	15	0
,, Extra B.H.S.	7	15	0
,, Extra Best Cable	8	5	0
,, Rivet	6	5	0
,, Best Scrap Rivet	7	5	0

	£	s.	d.
Angles—Phœnix	6	5	0
,, Best	6	15	0
,, Extra Best	7	5	0
Gas Tube Hoops—Phœnix Best	6	15	0
Plates—Phœnix	—		
,, Best Boiler	7	10	0
,, Best Best Boiler	8	0	0
,, Extra Best Boiler	9	0	0
Boiler Tube Strips—Phœnix Best Best	8	0	0

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote Commission extra).

Pig Iron:	No. 1. £	s.	d.	No. 3. £	s.	d.
Coltness, f.a.s. Glasgow	3	4	6	2	14	0
Gartsherrie ,,	2	19	0	2	14	0
Summerlee ,,	2	19	0	2	14	0
Carnbroe ,,	2	16	6	2	12	6
Langloan ,,	3	4	0	2	15	0
Calder ,,	2	19	0	—		
Clyde ,,	2	18	6	2	13	6
Glengarnock, f.o.b. Ardrossan	2	18	0	2	12	6
Eglinton ,, ,,	2	14	6	2	12	6
Dalmellington, ,, Ayr	2	14	6	2	12	6
Shotts ,, Leith	2	19	0	2	14	6

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works:—**

	£	s.	d.
W.W. Bars	6	12	6
W.W. Best Bars	7	2	6
W.W. Best Best	7	12	6
W.W. Best Best Best	8	2	6
W.W. Best Shoe	7	2	6
Thornaby	8	2	6
Thornaby Best	8	12	6
Thornaby Best Best	9	12	6
Whitwell Special Admiralty Cable	10	5	0
Special Chain Iron	9	5	0
Tube and Nail Strips	6	15	0
W.W. Angle Iron	6	15	0
W.W. Best Angle Iron	7	5	0
Tee Iron, to 8-inches United	7	12	6

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington, quote:—

		Iron. £	s	d.	Steel. £	s.	d.
(BNF)	Bars	6	10	0	6	15	0
	Angles	7	0	0	7	5	0
	Tees	7	10	0	7	15	0
W.I.W	Hoops	7	0	0	7	10	0
	Sheets	7	10	0	8	0	0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.
Extras for Sizes and Cutting as per List.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote:—

Black Sheets:	Singles 20 G 96in. by 36in. per ton. £	s.	d.	Doubles 21 G to 24 G 96in. by 36in. per ton. £	s.	d.
"Vale"	10	0	0	10	10	0
"Shield"	10	10	0	11	10	0
"Severn"	11	10	0	12	10	0
"Baldwin Wilden B."	12	10	0	13	10	0
Charcoal	16	10	0	17	10	0
Best Charcoal	18	10	0	19	10	0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:	£	s.	d.	£	s.	d.
No. 3 Lead	13	10	0	14	10	0
S.V. Lead	15	0	0	16	0	0
No. 3 Terne	15	0	0	16	0	0
S.V. Terne	16	10	0	17	10	0

Tinned Sheets:	Singles 20 G to 108 by 36in. per ton. £	s.	d.	Doubles 21 to 24 G to 96 by 36in. per ton. £	s.	d.
Best Coke (Finish)	28	0	0	29	10	0
,, Charcoal (Finish)	30	0	0	31	10	0
Extra ,, ,,	32	0	0	33	10	0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for.

Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box.

Extreme sizes in Tin and Patent Coated specially quoted for.

Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.

At works less 2½% for cash monthly, 10th inst.

Galvanized Corrugated Sheets:	£	s.	d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	11	12	6	per ton.
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London	14	5	0	,,

Galvanized Working Up-Sheets:	£	s.	d.	
24 G., f.o.b. London, in Bundles	13	12	6	per ton.

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote:—

	£	s.	d.	
Crown Bars	6	10	0	per ton.
Best Bars (1 to 6in. wide, above ¼ in. thick, ½ in. to 4 rounds and squares)	7	0	0	,,
Angles	6	15	0	,,
,, Best	7	5	0	,,
T's	7	0	0	,,
,, Best	7	10	0	,,
Best Shoe Iron	8	0	0	,,
,, Rivet Iron	8	0	0	,,
,, Best Rivet (Special)	9	5	0	,,
,, Cable	9	5	0	,,
,, Screwing	8	5	0	,,

	£	s.	d.	
Best Turning	8	0	0	per ton.
,, Plating	8	5	0	,,
Best Best	9	5	0	,,
Treble Best	10	5	0	,,
Plates	7	10	0	,,
Best Plates	8	0	0	,,
,, Boiler Plates	8	10	0	,,
,, Best Boiler Plates	9	10	0	,,
Treble Best Boiler Plates	12	0	0	,,

Delivery f.o.b. Liverpool, Birkenhead or Manchester.

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails, steel nails, &c.

Discounts—

45 per cent. off 1-inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound.

40 per cent. off 3½ inch to 7-inch strong rose and 10dy. and 20dy. pound.

40 per cent. off all sharp-pointed nails.

Delivered in lots of 4 cwt. and upwards. Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis:—

2 tons 9/6 per cwt.
4 cwt. lots and upwards 9/9 per cwt. } d/d any Railway Station.

Steel cut nails, 3-inch basis—

2 tons 8/3 per cwt.
4 cwt. lots 8/6 per cwt. } d/d any Railway Station.

Slit rods (iron) £7 10s. per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E. C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote:—

	Per Box. f.o.b. Wales. £	s.	d.
Coke Tin-plates.			
C 18¾ by 14 124s. 110 lb. "BV"	0	12	0
C 20 by 10 225s. 155 ,, "Jumbo"	0	17	0
C 20 by 14 112s. 108 ,, "Lydbrook"	0	11	9
C 28 by 20 112s. 216 ,, "Lydbrook"	1	3	9
Charcoal Tinplates:			
C 20 by 14 112s. 108 lb. "Allaway"	0	12	6

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes:—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

		£	s.	d	
Steel:					
Blooms	at	3	14	0	per ton.
Billets	at	3	16	0	,,
Sheet Bars	at	3	18	0	,,
Finished Steel:					
Bars	at	5	1	0	per ton.
Angles	at	5	2	0	,,
Tees	at	5	5	0	,,
Joists	at	4	10	0	,,
Fencing Standards	at	5	2	0	,,
Shoeing Bars	at	5	4	0	,,
Tyre Bars	at	5	4	0	,,
Half-Round Bars	at	5	5	0	,,
Heavy Rails	at	4	15	0	,,
Light Rails	at	4	17	6	,,

Structural Steelwork:

Prices on application.

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote:—

TIN.

Tin:	£	s.	d.		£	s.	d.	
English Ingots, f.o.b. Dis. 1¼% & 1%	139	10	0	to	140	0	0	per ton.
English Bars, f.o.b. Dis. 1¼% & 1%	140	10	0	to	141	0	0	,,
Straits G.M.B., cash Warehouse, Net	139	5	0	to	139	10	0	,,
Straits G.M.B., 3 months, Warehouse, Net	134	12	6	to	134	15	0	,,
Australian, Mt. Bischoff, Warehouse, Net	139	5	0	to	139	10	0	,,

COPPER.

Copper:	£	s.	d.		£	s.	d.	
Standard G.M.B., cash Warehouse, Net	66	17	6	to	67	0	0	per ton.
Standard G.M.B., 3 months, Warehouse, Net	67	6	3	to	67	7	6	,,
English, Tough, Cake & Ingot, Warehouses, Net	70	15	0	to	71	0	0	,,
English, Best Select, Warehouse Net	71	15	0	to	72	5	0	,,
English, Sheets and Sheathing, f.o.b., Dis. 2½%	81	0	0	to	82	0	0	,,
English, Sheets for India, f.o.b., Dis. 2½%	76	0	0	to	76	10	0	,,
Electro, Warehouse, Net	70	15	0	to	71	0	0	,,
Ore, ex. ship	0	12	0	to	0	13	0	per unit.
Regulus, Matte and Precipitate, ex. ship,	0	13	3	to	0	14	0	,,

YELLOW METAL.

Yellow Metal:

	£	s.	d.	£	s.	d.	
Sheets, 4 by 4 feet for India f.o.b. Dis. 2½%				0	0	6¾	per lb.
Sheathing ,, ,,				0	0	6⅞	,,

SPELTER.

	£	s.	d.		£	s.	d.	
Silesian outports, Net	23	16	3	to	23	17	6	per ton
Blende of 50 % Net	6	11	6	to	6	15	0	,,
Calamine, Net	6	14	0	to	6	15	0	,,

LEAD.

	£	s.	d.		£	s.	d.	
English Pig, Warehouse, Dis. 2½%	12	15	0	to	12	17	6	per ton.
Spanish, ex ship, Dis. 2½%	12	10	0	to	12	11	3	,,
Lead Ore of 70 %, Net	6	2	6			--		,,

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus, f.o.b., Dis. 2½ %	35	0	0	to	36	0	0	per ton.
Ore, 50 %, ex ship, Dis. 2½%	9	10	0	to	10	10	0	,,
Crude, ex ship, Dis. 2½ %	15	0	0	to	17	10	0	,,

QUICKSILVER.

	£	s.	d.	
Spanish, 75 lb., Warehouse, Net	7	12	6	per flask.
Italian ,, ,, ,,	7	11	6	,,

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage —

Upper Main Seam.	s.	d.
Main Coal	7	0
Best Hard Steam (hand picked, as used by the Railway Companies)	5	6
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	5	6
Fine Slack	0	6

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston quote as follows, per ton at pit :

Kilburn Coal :	s.	d.
Best London Brights	9	9
Large Nuts (1½ to 3½)	9	6
Small Nuts (¾ to 1½)	6	0
Rough Brights	6	0
Peas (⅜ to ¾)	5	0
Slack	3	6
Smudge	2	0

Low Main (or Tupton) Coal :

Low Main Brights	7	6
,, ,, Nuts	7	3
Hards (Good Steam Coal)	8	0
Bakers' Nuts (1" to 2")	6	6
Slack	3	6

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

	per ton at pit. s.	 d.
Best Main Coal	10	6
Best Silkstone	10	0
Best House Coal	8	6
Best House Nuts	8	0
Treble Screened Cobbles	7	9
Best Cobbles	7	3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit :—

Digby Coal :

Steam.	s.	d.
Best Hand Picked Hard	8	6
Steam Hard	7	3
Hard Nuts	6	6

Gedling Colliery.

High Hazel.		
London Brights, 4 to 8 in. cube	10	6
Large Nuts, 2 to 4 in. cube	8	6
Small Nuts, 1 to 2 in. cube	6	0
Pea Nuts, ⅜ to 1 in. cube	5	0

Steam.—Top Hard.		
Best Hard	8	6
Hard Steam	7	6
Cobbles	6	6

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote :

	£	s.	d.	
Acids : Oxalic	0	0	2½	per lb.
Picric, Crystals	0	0	11	,,
Tartaric .... at Manchester	0	0	10⅞	,,

	£	s.	d.	
Acetate of Lime: Brown at Manchester net	9	10	0	per ton.
Grey ,,	11	15	0	,,
Alumina : Alum, Lump, loose	5	5	0	,,
,, ,, in casks	5	7	6	,,
,, Ground, in bags	5	15	0	,,
Sulphate of Alumina, 14%	4	10	0	,,

Ammonia : Carbonate	0	0	3⅝	per lb.
Muriate Grey f.o.b. Liverpool	23	15	0	per ton.
Sal-ammoniac, Lump, 1sts, del^d. U.K.	42	0	0	,,
,, ,, 2nds, ,,	40	0	0	,,
Sulphate .... f.o.b. Liverpool	12	15	0	,,
Arsenic : Best White Powdered ....net	12	5	0	,,
Bleaching Powder, 35% .... ,,	4	10	0	,,
Borax : British Refined Crystal......... ,,	12	0	0	,,

Coal Tar Products :				
Benzole, 50/90 % ,,	0	0	6	per gal.
,, 90% ,,	0	0	7	,,
Carbolic Acid Crystals, 34/35° C. ... ,,	0	0	6	per lb.
,, ,, ,, 39/40° C. ... ,,	0	0	6¼	,,
,, ,, Liquid, 97/99 % ... ,,	0	0	9	per gal.
,, ,, Crude, 62½% at 60° F. f.o.b. ,,	0	1	9	,,
Creosote, ordinary good liquid...... ,,	0	0	$1\frac{7}{16}$	,,
Naphtha, Crude, 20 % at 120° C.... ,,	0	0	3	,,
,, Solvent, 90% at 160° C. f.o.b ,,	0	0	8	,,
,, ,, 95 % at 160° C. ,, ,,	0	0	9	,,
,, ,, 90 % at 190° C. ,, ,,	0	0	10	,,
,, Rectified, flash point over 73° F. ....f.o.b. ,,	0	0	11	,,
,, Rectified, flash point over 100° F. ....f.o.b. ,,		1	0	,,
Naphthalene, all qualities.				
Pitch..............f.a.s. Manchester. ,,	1	9	0	per ton.
Copperas : Green, in bulk ,,	0	12	6	,,
,, barrels f.o.b. L'pool ,,	1	19	0	,,
Cake ,,	1	2	6	,,
Copper : Sulphate	21	12	6	,,

Cyanides : 98% minimum ......f.o.b. net	0	0	7½	per lb.

Lead : Acetate (Sugar) White, English......	27	10	0	per ton.
,, ,, ,, Foreign c.i.f. U.K	23	5	0	,,
,, ,, Grey	21	15	0	,,
,, ,, Brown at Manchester	16	15	0	,,
Nitrate	24	0	0	,,
Litharge, Flake	15	10	0	,,
,, Powder	16	0	0	,,
Red Lead, Genuine, c.i.f. London less 5%	15	10	0	,,
White ,, ,, Dry ,, ,, ,,	16	15	0	,,

Naphtha (Wood) : Miscible, 60 o.p.	0	2	10	per gal.
Solvent	0	2	7	,,

Potash : Bichromate... delivered England...	0	0	3	per lb.
Carbonate, 90/92 % ... c.i.f Hull ...	18	10	0	per ton.
Caustic, 75/80 % ...... ,, ,, ...	20	15	0	,,
Chlorate ....net	0	0	$3\frac{1}{16}$	per lb.
Montreal.........in Store, Liverpool	35	0	0	per ton.
Prussiate, Yellow ....net	0	0	5	per lb.

	£	s.	d.	
Soda: Ash, Caustic, 48 %, Ordinary ... net	5	5	0	per ton.
,, ,, ,, Refined...... ,,	6	5	0	,,
,, Carbonated, 48 %............ ,,	5	10	0	,,
,, ,, 58 % (Ammonia Alkali) ....net	4	10	0	,,
,, Bleachers' Refined Caustic 50/52 % .... net	6	10	0	,,
Caustic, White, 77 %................ ,,	10	10	0	,,
,, ,, 70 %................ ,,	9	12	6	,,
,, ,, 60 %................ ,,	8	12	6	,,
,, Cream, 60 %.............. ,,	8	10	0	,,
Crystals, in bags	3	0	0	,,
,, barrels	3	7	6	,,
Acetate .... c.i.f. Hull net	16	15	0	,,
Bicarbonate, in 1 cwt. kegs............	6	15	0	,,
Bichromate......delivered England...	0	0	2¼	per lb.
Chlorate .... net	0	0	$3\frac{1}{16}$	per lb.
Nitrate...ex quay Liverpool, ... ,,	11	5	0	per ton.
Phosphate	9	5	0	,,
Prussiate ....net	0	0	3⅝	per lb.
Silicate, Solution, 140° Tw.	4	10	0	per ton.
Sulphate (Glauber Salts)................	1	12	6	,,
,, (Saltcake, 95%)................	1	15	0	,,
Sulphur: Recovered	4	15	0	,,
Roll	6	15	0	,,
Flowers.....................................	7	10	0	,,
Zinc: Sulphate	6	15	0	,,
Shellac: Standard TN orange spot	7	10	0	per cwt.

MINERALS.

Messrs. S. W. Royse and Co., quote:—

	£	s.	d.	
Barytes: Lump Carbonate, 90/92%	3	10	0	per ton.
Sulphate, No. 1, White	2	15	0	,,
China Clay: of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore: Basis 50% c.i.f. British Ports..........................	3	7	6	,,
Manganese: Lump c.i.f. Liverpool 10¼d.	per metallic unit.			
Ochre: French JC .... f.o.b. Rouen, net	2	5	0	per ton.
,, JF	5	10	0	,,
Talc: (French Chalk).........c.i.f. Liverpool	3	10	0	,,

Messrs. Henry Bath and Son, quote:—

	£	s.	d.		£	s.	d.	
Copper, Ores of, 10 to 25%	0	12	1½	to	0	13	1½	per unit.
Regulus, 45 to 55%	0	13	4½	to	0	13	10½	,,
Precipitate, 65 to 80% ...	0	13	7½	to	0	14	1½	,,
Tin Ores, 70 %...............	86	0	0	to	88	0	0	per ton.
Lead Ore, 70%..................					6	5	0	,,
Blende, 50%					6	9	6	,,
Calamine.........................					6	12	0	,,
Antimony Ore, 50%......	7	10	0	to	8	10	0	,,

Messrs. Barrington and Holt, Cartagena, quote:—

Iron Ore.

			s.	d.	
Ord. 50%, ...	f.o.b.	Porman	6	5	per ton.
Do.	,,	Cartagena	6	8	,,
Special low phos.	,,	Porman	7	1	,,
Do. do.	,,	Cartagena.............	7	4	,,
Extra quality do.	,,	,, ...	7	8	,,
Special Iron Ore	,,	,, ...	8	4	,,
Specular 58% do.	,,	,, ...	9	4	,,

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote:—

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d.
Quebec Square White Pine...	per cub. ft.	0	1	9	to	0	3	0
Quebec Waney Board Pine...	,,	0	2	8		0	3	9
St. John Pine, 18 in. average	,,	0	2	4		0	3	3
Lower Ports Pine..............	,,	0	1	3		0	1	8
Quebec Red Pine	,,	0	1	6		0	2	0
Quebec Oak, 1st quality	,,	0	2	9		0	3	4
Quebec Oak, 2nd quality ...	,,	0	1	6		0	2	6
Ash	,,	0	1	6		0	2	3
Elm	,,	0	3	3		0	3	10
Hickory	,,	0	2	0		0	2	6
Quebec Birch	,,	0	1	6		0	2	3
St. John Birch	,,	0	1	6		0	2	0
Birch Planks......................	,,	0	0	9		0	0	11
Spruce Spars	,,	0	0	10		0	1	0

Deals.

		£	s.	d.		£	s.	d.
1st quality Quebec Pine	per std.	22	10	0	to	32	10	0
2nd do. do.	,,	17	0	0		22	0	0
3rd do. do.	,,	11	10	0		13	0	0
St. John, N.B., etc., Spruce	,,	6	15	0		7	5	0
Lower Ports Spruce.....	,,	6	10	0		6	15	0
Spruce Boards.................	,,	5	10	0		6	0	0

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s.	d.		£	s.	d.
Hewn	per cub. ft.	0	1	4	to	0	1	8
Sawn	,,	0	0	11		0	1	6
Planks, Stowage	,,	0	0	10		0	1	0
Boards, Prime	per std.	12	10	0		16	0	0
Oak Timber	per cub. ft.	0	1	6		0	2	6
Oak Planks	,,	0	1	6		0	2	1
East India Teak...............	per load	12	0	0		16	0	0
Greenheart.....	,,	6	15	0		7	10	0

EUROPEAN WOODS.

Timber.

		£	s.	d.		£	s.	d.
Riga Redwood	per cub. ft.	0	1	6	to	0	2	0
Dantzic and Memel Fir, Crown	,,	0	2	1		0	2	6
Dantzic and Memel Fir, Middling	,,	0	1	9		0	1	11
Stettin	,,	0	1	9		0	1	11
Swedish	,,	0	1	0		0	1	3
Riga Whitewood	,,	0	1	0		0	1	3
Norway Mining Timber	,,	0	0	9		0	1	0
Dantzic and Stettin, etc., Oak..	,,	0	2	6		0	3	0
Norway Spars.................	,,	0	1	2		0	1	9

Deals.

		£	s.	d.		£	s.	d.
Red Archangel and Onega, 1st quality	per std.	19	0	0		20	0	0
Red Archangel and Onega, 2nd quality	,,	14	0	0		16	0	0
Red Archangel and Onega, 3rd quality	,,	10	10	0		12	10	0
St. Petersburg, 1st quality...	,,	16	0	0		17	10	0
Do. 2nd ,, ...	,,	14	0	0		15	0	0
Gefle	,,	11	10	0		16	0	0
Wyburg	,,	11	0	0		12	10	0
Uleaborg	,,	10	0	0		12	10	0
Gothenburg	,,	11	0	0		16	0	0

SELECTED PATENTS.

Compiled expressly for this journal by **Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C.,** and at Manchester.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton Buildings, Chancery Lane, W.C., at the uniform price of 8d.

NEW PATENTS APPLIED FOR.

When Patents have been communicated the names of the communicators are printed in *italics*.

5783. G. Burton, Portslade. March 20th.—An improved automatic twin or triple valve tap for water, steam, and the like.

5786. T. B. Jones, Dronfield. March 20th.—Apparatus for the prevention of stopped ascension pipes, connected with gas retorts.

5788. W. Shapland, Aberystwyth. March 20th.—Improvements in devices for the production of mechanical energy from gaseous products of combustion.

5792. A. J. Cooper, Liverpool. March 20th.—Improvements in turbines.

5793. W. D. Bowness, E. T. Bowness, and S. Spence, Liverpool. March 20th.—Improvements in or connected with steam generators.

5803. A. Felstead, East Leake. Improvements in and relating to crank shafts and driving shafts.

5804. W. Drummond and G. W. Drummond, London. March 20th.—Improvements in feed pumps for locomotive boilers.

5811. W. J. Poole, Glasgow. March 20th—Improvements in or connected with heat motors, applicable in part to compressors, exhausters and the like.

5817. R. Simpson, Swansea. March 20th—A method for the direct conversion of iron into steel (*a*) in the blast furnace, or (*b*) immediately outside it. (*D. I. R. Simpson, Transvaal.*)

5841. H. T. Gould, London. March 20th.—Improvements in plate valves.

5867. P. Schou, London. March 20th.—Improvements in thrust-bearings for revolving shafts.

5870. K. A. A. Staahlgren, London. March 20th.—Improvements in rotary engines.

6885. J. B. V. Oosterwyck, London. March 20th.—Improvements in devices for producing steam.

5797. H. Coley and T. Greaves, Newburn-on-Tyne. March 21st.—A new device fire-bar for locomotives and stationary boilers and the like.

5898. J. Reed, Torquay. March 21st.—An improvement which facilitates repairs and adjustments of ball-valves by an arrangemnnt which obviates the awkward operation of removing the pin fastener.

5917. W. R. Darling, Glasgow. March 21st—Improvements in self-closing valves.

5922. W. Wier, London. March 21st.—Improvements in and connected with feed-water heaters.

5923. R. Firth, Leeds. March 21st.—Valve gear.

5943. E. H. Beckett, Hayes. March 21st.—Improvements in heating apparatus.

5947. W. Fullard, London. March 21st.—Improvements in excavating and dredging machines.

5956. W. J. Wallett, London. March 21st.—Improvements in lock nuts.

5961. C. H. Chapman, London. March 21st.—Improvements in and relating to ball carriers for ball bearings.

5962. C. H. Chapman, London. March 21st.—Improvements in and relating to ball retainers for ball bearings.

5963. The National Gas Engine Co., Ltd., H. W. Bradley, and P. W. Robson, London. March 21st.—Improvements relating to valve controlling means for engines.

5966. R. M. Dowie, and The Keystone Driller Co., London. March 21st—Improvements in drilling machines.

5972. T. Jones, Liverpool. March 21st.—Improvements in means for transporting or conveying metal bars and the like.

5975. J. Evans, and D. Lewis, London. March 21st.—Improvements in or relating to hot blast stoves and the like.

5990. John Stanislaus Glenn, and Harry Henke, London. March 21st.—Improvements in locomotive boilers.

5991. Theodore H. Stringer, and A. Liwentaal, London. March 21st.—An improved manufacture of propellers for propelling air-ships and like purposes.

5995. S. J. Lawrence, London. March 21st.—An improved rotary engine.

R. F. C. Keats, Portsmouth. March 22nd.—An improved rotary steam or other fluid engine.

6001. T. S. Anderson, Sheffield. March 22nd.—Improvements in the method of and apparatus for the smelting of ores, iron sand, and the like, and subsequent conversion into steel or other metals or alloys.

6005. B. R. Rowland, Manchester. March 22nd.—Improvements in steam boilers and apparatus for superheating steam.

6008. J. J. Tinker, Manchester. March 22nd.—Improvements in and connected with steam junction and the like valves.

6012. H. Burrell, London. March 22nd.—Improvements in cranes for cargo steamers.

6069. W. B. Downey, London. March 22nd.—Improvements in and relating to driving bands.

6076. J. T. Day, London. March 22nd.—Improvements in power transmission.

6078. D. B. Morison, London. March 22nd.—Improvements in or relating to tubular surface condensers and heaters.

6087. M. Hanrahan, Limerick. March 23rd.—Inside leak-stopping screw rivet.

6105. J. Guthrie, Grays. March 23rd.—Improved smoke-box doors for marine boilers.

6112. A. Ball, Nottingham. March 23rd.—An improved composition for the prevention and removal of incrustation and corrosion in steam boilers and the like

6118. T. White and W. Christie, Glasgow. March 23rd.—Improvements in guards for circular saws.

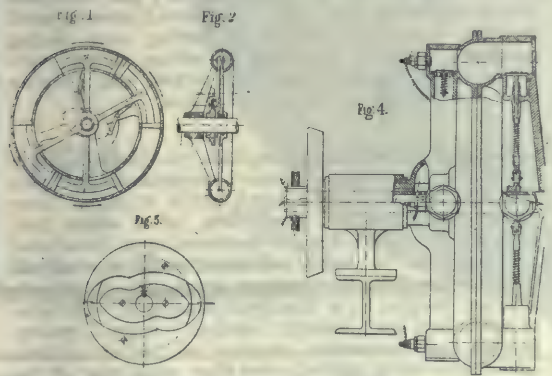
6124. F. C. Dolby, Coventry. March 23rd.—Improvements in or relating to detachable link driving chains.

6125. King's Norton Metal Co., Ltd., T. A. Bayliss, H. M. Smith and H. W. Brownsdon, London. March 23rd.—A new or improved treatment of bullets and other projectiles and submarine and other vessels.

RECENT SPECIFICATIONS.

ROTATORY ENGINE.

Henri Leon Maillard, of Paris. Feb. 23rd, 1904.—This invention relates to a rotary engine which will work under the action of any compressed fluid, and also as an explosion or internal combustion engine. An engine, according to this invention, is illustrated by way of example in the accompanying drawing, in which it is shown as arranged to work as an explosion engine. In this case it is a petrol engine, more particularly intended for propelling motor vehicles, where light weight is of the greatest importance. The engine works by means of a fluid under pressure or by explosion or combustion of combustible mixtures characterised by the combination with a rim in which move four reciprocating pistons, of a connecting device between the pistons and the rim with a view to impart to the latter a continuous rotary motion; the connection of each piston to the rim is effected by means of a bent lever pivoted at one end to the piston and capable of oscillating, and at the other end to a pin secured to an arm connecting the rim to a sleeve loosely mounted on a fixed central spindle, the bent lever being provided near the centre of the apparatus with a roller engaging with a cam groove made in a part secured to the fixed spindle and the curve of which has a shape depending on the number of oscillations that each piston is to make per revolution of the rim.



STEAM BOILER SUPERHEATERS.

Francis John Cole, of Schenectady, New York. Dec. 29th, 1904.—This invention relates to superheaters, and its object is to provide a superheating appliance of a type in which the length of the traverse of the steam to be superheated, while exposed to the hot gases, shall be largely increased relatively to any determined length of superheating fire tube, and the superheating of the steam be consequently effected to a correspondingly higher degree. The invention is shown applied to a locomotive boiler of ordinary construction, the device consists of superheating fire tubes and a set of fire superheater pipes located therein, each constituting a continuous channel for a double return of steam; a main steam supply pipe, a steam delivery pipe, and a casing or header divided into compartments, are also provided; one compartment communicates with the steam supply pipe and with the receiving end of one of the superheater pipes; another compartment communicating with the delivery end of another superheater pipe and with the delivery steam pipe, and a third compartment establishing communication between the ends of the two other superheater pipes, midway of the continuous steam channel. In its traverse through the superheater pipes, the steam is thoroughly superheated by the hot products of combustion which pass through the superheating fire tubes, and the superheater pipes as above described, the length of its traverse in the pipes, and the period of its exposure to the hot products of combustion being materially increased over other superheaters.

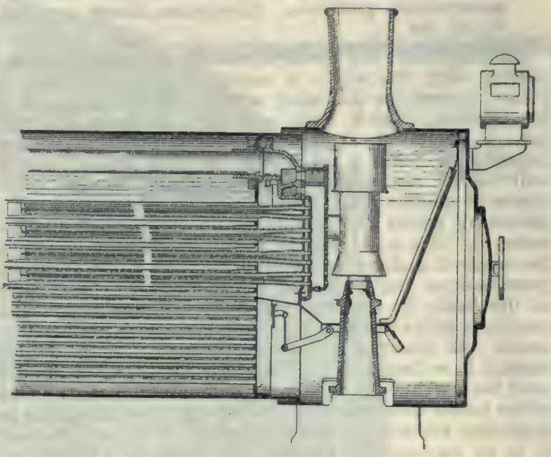


FIG. 1.

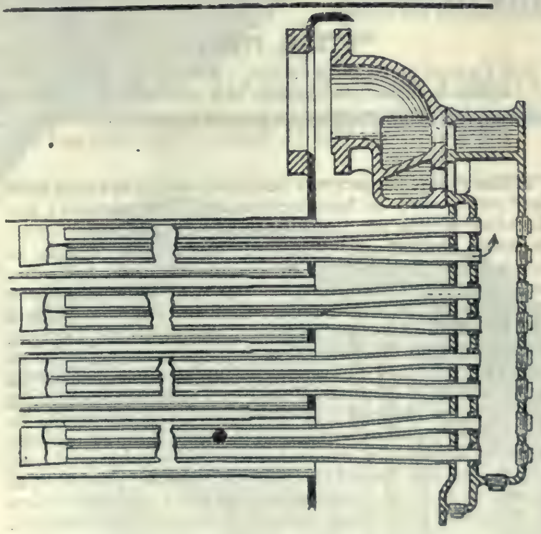


FIG. 2.

NEW PUBLICATIONS.

"A CLASS-BOOK OF NAVAL ARCHITECTURE."

Practical, Laying off, Theoretical. By W. J. Lovett. With numerous illustrations and almost 200 fully worked-out answers to recent Board of Education examination questions. Longmans, Green and Co. 7s. 6d. net.

Although there are already a number of excellent books dealing with the study of naval architecture, there is plenty of room for this latest addition to the literature of the subject, which was specially designed for the use of technical students. Hitherto they have been unprovided with a class-book of this nature, which will serve not only to carry them through their course of studies, but also as an introduction to the advanced works on this important section of British industry. The book will be found peculiarly adapted to the needs of students working for the Board of Education examinations, as the syllabus of that course has been used as the basis for the work; the worked-out answers to questions set by the Department should prove particularly useful. All abstruse matters not bearing directly on the subject have been excluded, and all technical statements have been written in a manner readily assimilated. The writer insists that a thorough knowledge of mathematics is absolutely essential if the science of naval architecture is to be successfully studied; he therefore advises the study of both subjects concurrently.

After discussing areas, centres of gravity, displacements, centres of buoyancy, weights and stowages, the author deals with statical stability, which is followed by some explicit information on launching arrangements. Other sections of the work are devoted to, strength; tonnage, freeboard, corrosion and fouling; rudders, horse-power, propellers; curves, coefficients, approximations; laying off; Lloyd's and British Corporation; Lloyd's rules and B.C. rules; the ship in detail, and Board of Education examination particulars.

"STEAM PIPES."

Their Design and Construction. A treatise of the principles of steam conveyance and means and materials employed to practice, to secure economy, efficiency, and safety. By Wm. H. Booth. Constable and Co., Ltd. 5s.

Hitherto this subject has been one which has only been dealt with more or less incidentally; the compiler has therefore done a good service in bringing together a very desirable amount of interesting information relating to steam pipes and issuing the same in such a readily accessible form. Those who have to cope with the various problems encountered in steam engineering will find Mr. Booth's work of considerable usefulness. Among other points he discusses the flow of steam, equation of pipes, thickness of pipes, expansion, co-efficients, spring bends, strength of pipes, Board of Trade rules, isolating valves, water hammer, superheated steam, extensions to existing pipes, relative position of boilers, modern boiler capacity, separators, exhaust heads, atmospheric valves, and the kinetic theory of gases in relation to the flow of steam. A word of commendation is due to the publishers for the admirable manner in which the book is produced.

"GAS AND PETROLEUM ENGINES."

Edited by A. G. Elliott, B.Sc. Whittaker and Co. 2s. 6d.

A lucidly written treatise, well illustrated; the Diesel engine, and recent improvements made in the mechanical details of internal combustion engines, are described in his new edition in a manner that will be intelligible even to the non-technical reader.

NEW CATALOGUES.

George Swift, Claremont Iron Works, Halifax. This catalogue is made up from sheets on an ingenious plan, which admits the inclusion of the latest information the firm has to offer on the subject of machine tools and accessories. It has some excellent illustrations, and as the dimensions are all carefully stated it is well worth preserving for reference. The latest sheet describes a series of single-ended punching and shearing machines, punching from ¼ in. diameter to 1⅛ in. These machines are made when required with angle-iron cutting attachment at right angles to the large gear wheel worked by an eccentric on the gear wheel shaft. This, however, is only one of many points of interest, many new machines having been added to the list, while prices and details have been revised, and additional information regarding the machines has been included. A wide range of drilling machines is illustrated, including an improved motor-driven double-hinged radial drilling machine (No. 104, M.D.). This is a light radial drill designed to take in a large radius of work, and adapted for holes up to ¾ in. diameter. Being electrically driven it can be taken to different parts of the works, or to large jobs, instead of having to bring the work to the machine. It economically deals with a large number of holes at one setting, and bores holes in any part of a slab or casting within its radius. Improved power-geared slotting machines, horizontal boring and facing machines, planing machines, self-acting sliding, surfacing, and screw-cutting cap lathes, and shaping machines, also figure in this catalogue.

The General Electric Company, Ltd., 71, Queen Victoria Street.—From the publication department of this firm we have received a small batch of recent illustrated catalogues and pamphlets, all of which bear evidence of careful thought bestowed upon detail and arrangement. In some instances a high level has been reached in the matter of design. The 12th Edition (Section C) of the firm's illustrated catalogue of enamelled steel interior conduit "union" system fittings and accessories, reaches us in an artistic cover made up of plaited green fibre, while that of the 11th Edition of X Section, devoted to switchboards, traction panels, feeder pillars, excitation columns, motor and accumulator boards and switch gear, has an attractive plaster-modelled design. There is a frontispiece showing the switchboard erecting shop at the firm's Peel works, and a great deal of useful tabulated matter and information as to Board of Trade requirements, etc., will be found on reference to the index. Two neat little pamphlets describe respectively the firm's portable battery-driven electric fans and battery telephones and accessories for short-distance working. We have also received from the same company leaflets dealing with the new "Osmi" patent lamp, for which the triple advantages are claimed of "clear white light, less current, and long life."

Partridge and Cooper, Ltd., 191-2, Fleet Street, and 1 and 2, Chancery Lane, E.C.—"Modern Office Equipment" is the title of an attractive pamphlet on letter filing just issued by this firm. The "Referee" Horizontal or Front Filing System, the "Referee" Vertical Filing System, and the "Referee" Card Index are succinctly described.

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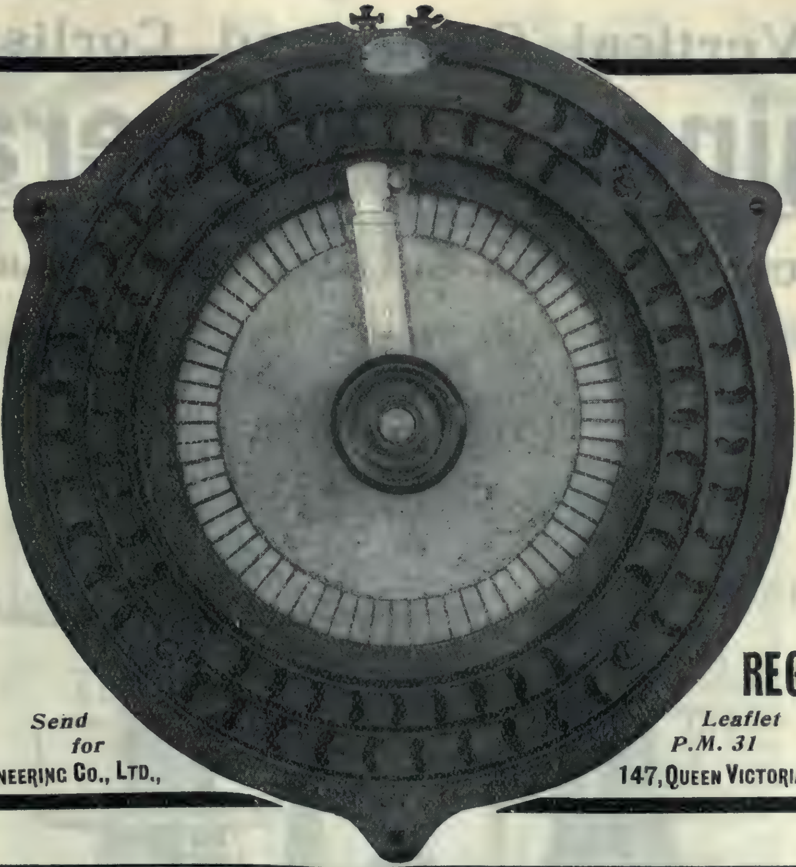

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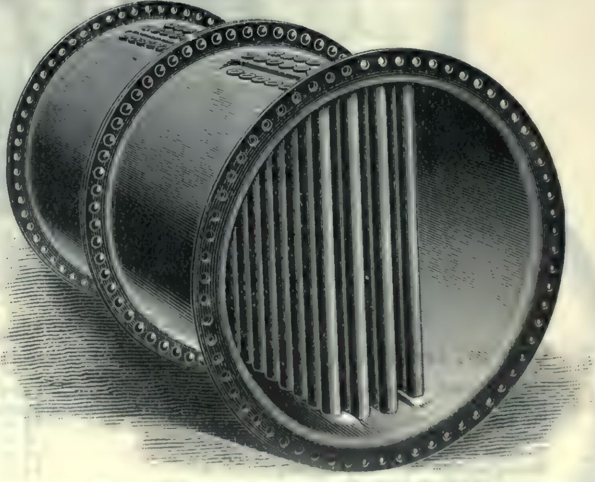

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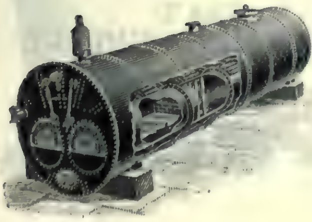

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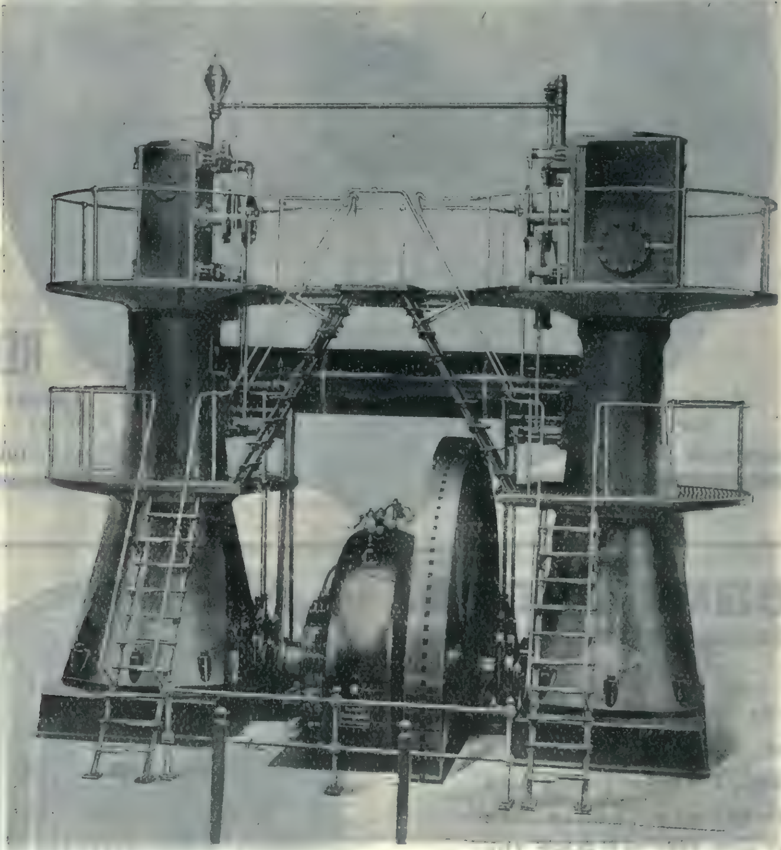

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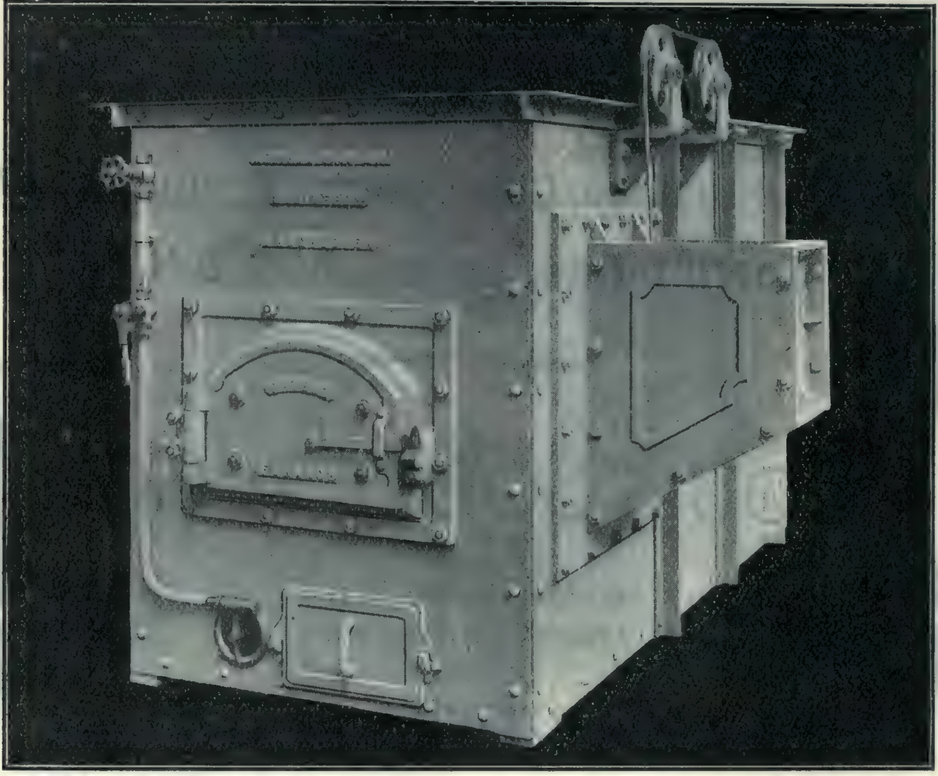

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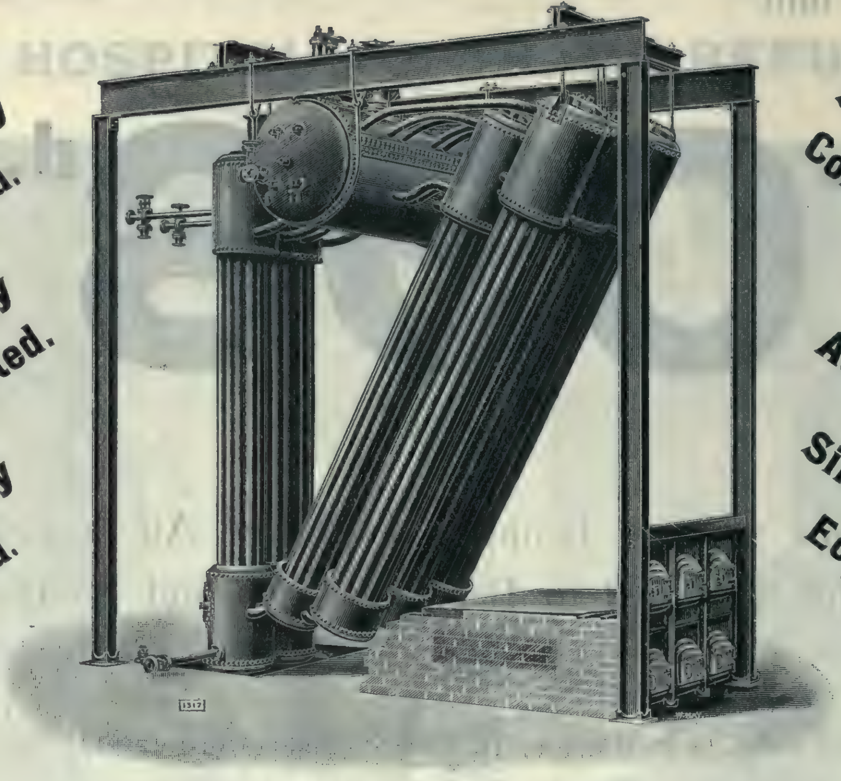

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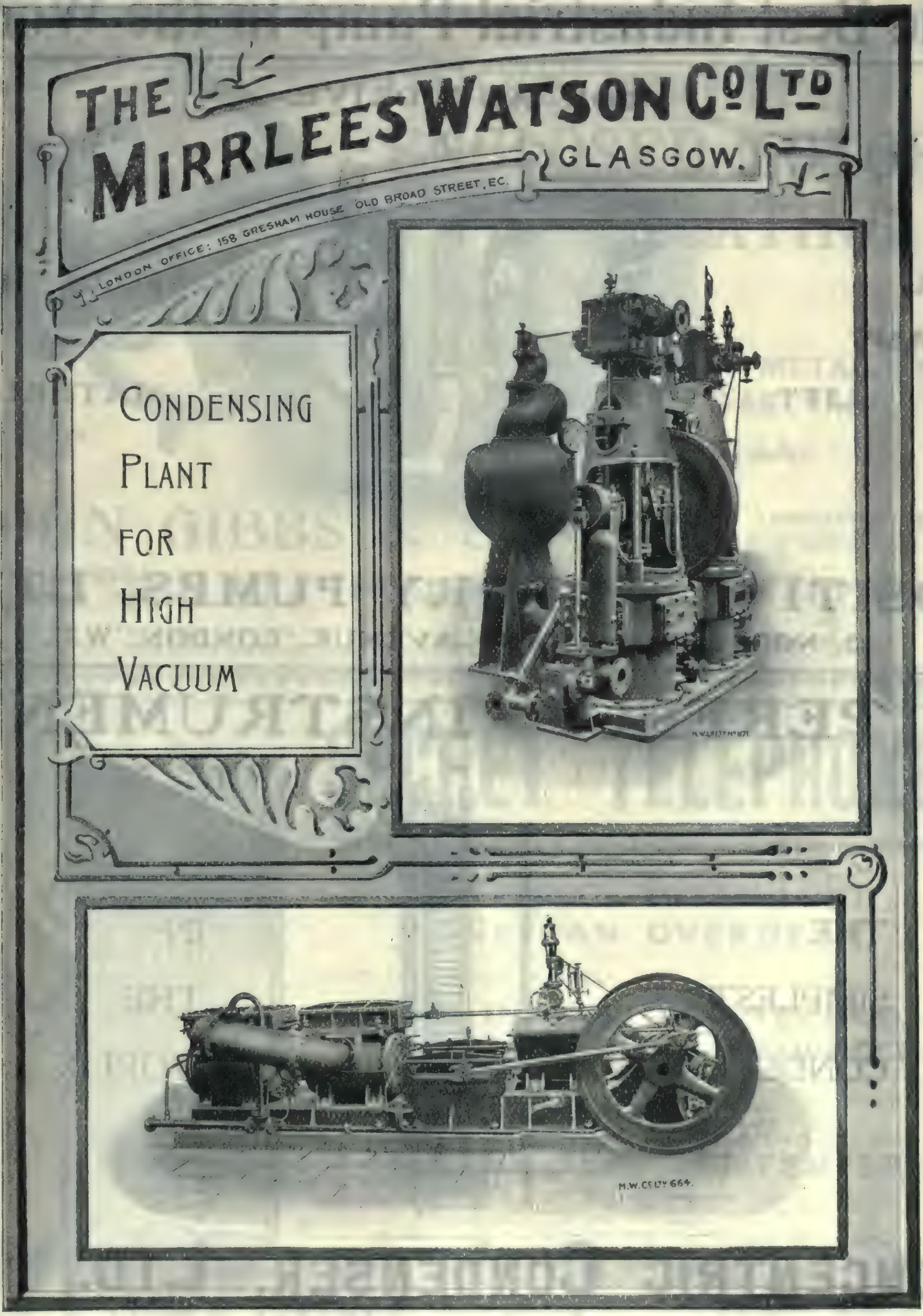

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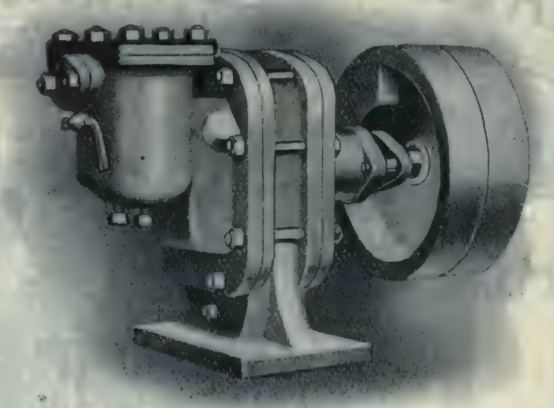

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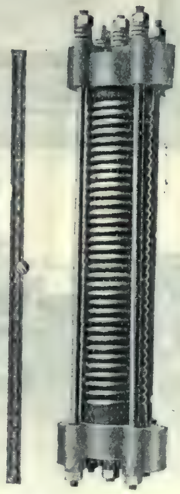

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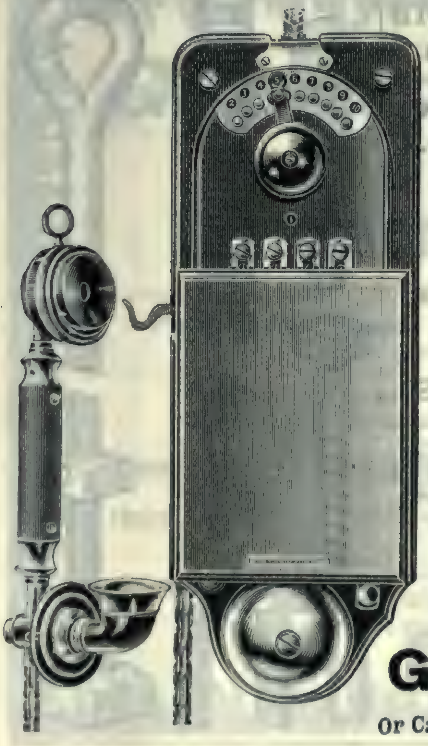

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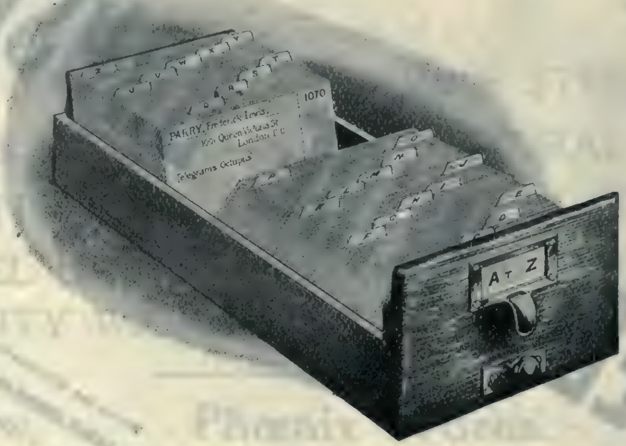

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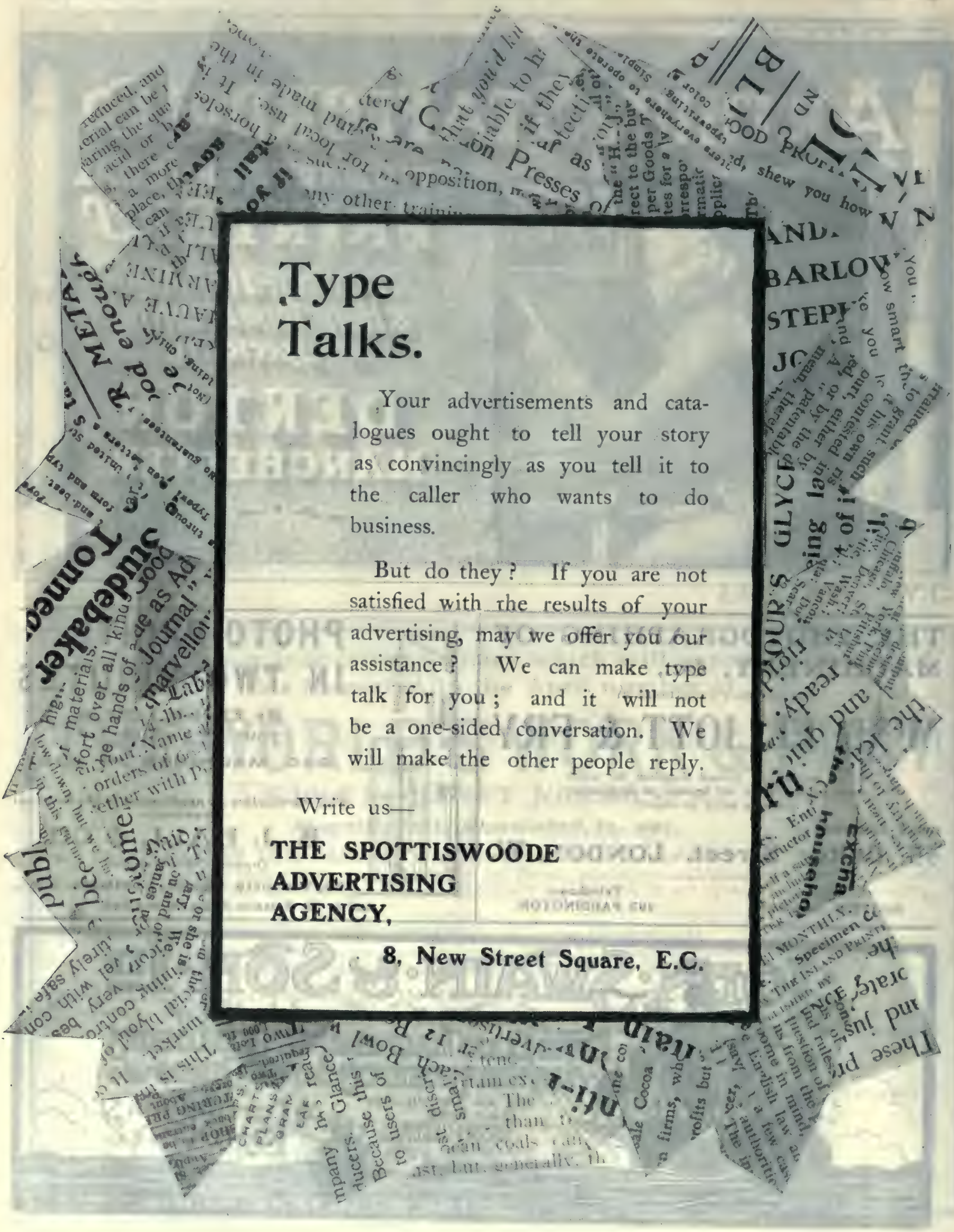

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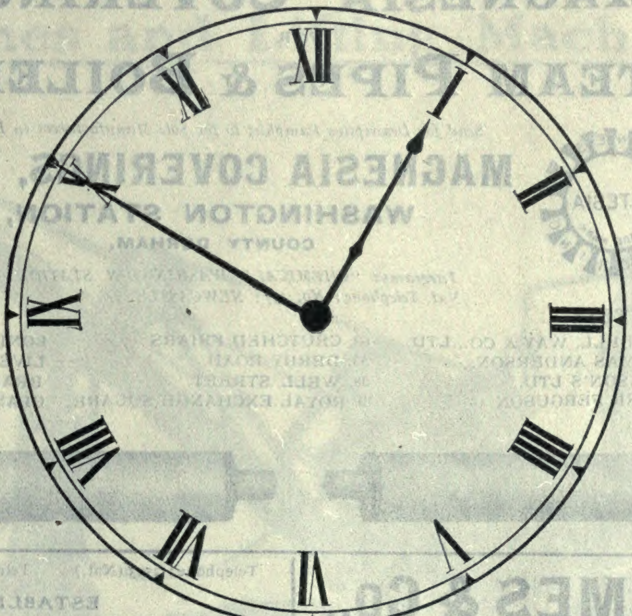

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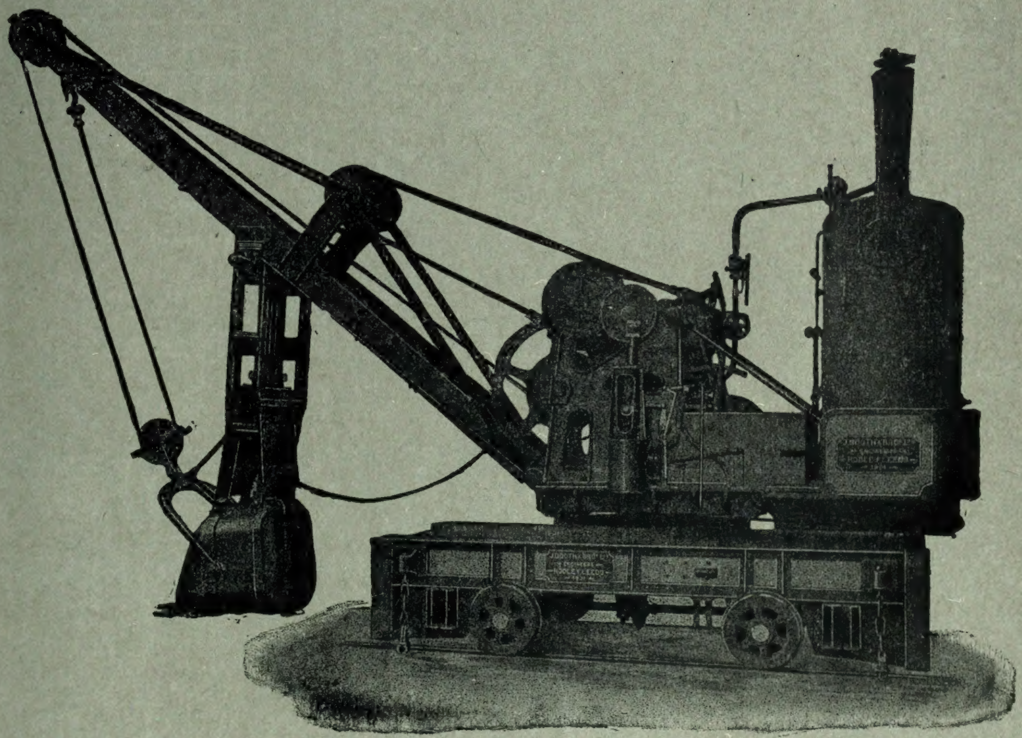

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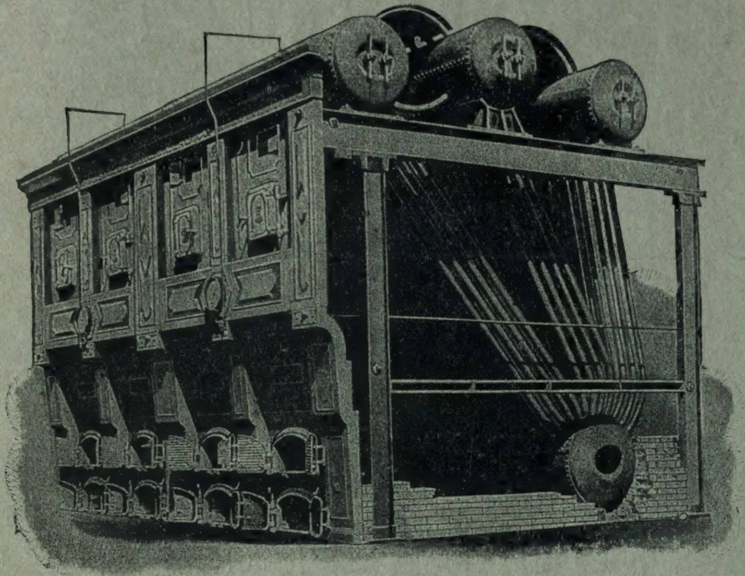

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